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**Inland Waters Directorate
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**Direction générale des eaux intérieures
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**HISTORICAL ANALYSIS OF WATER LEVELS
FOR SELECTED ALBERTA LAKES**

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EXECUTIVE SUMMARY

Water level statistics and analyses are presented for twenty-seven lakes in Alberta. Fifteen of those lakes are unregulated, have at least ten years of record to 1986, and were selected to show trends in runoff and water supply in their respective areas. Twelve other important lakes were selected and, notwithstanding their regulated status, may also be used to indicate trends in runoff and water supply.

Percentile plots are used to show the frequency for which the lakes have been at various levels on a daily basis. These plots also indicate the variation in observed water levels throughout the normal operating season of the hydrometric gauge.

The variation of seasonal mean water levels is shown by plotting transformed seasonal mean water levels on a time scale over the period of record. Trends toward higher or lower water levels become apparent, as does the occurrence of unusually high or low water levels.

Background information and qualitative interpretations of the water level analyses are provided for each of the selected lakes.

ABSTRACT

Water level statistics and analyses are presented for twenty-seven lakes in Alberta. Lakes selected for inclusion in this report were active in 1986 and had a minimum of 10 consecutive years of record.

This report presents the range and duration of water levels on both a daily and seasonal basis. It is also a useful tool to help identify the existence of trends, extraordinarily high or low water levels, and long term changes in the water level.

The historical water levels are shown in three formats: first, a listing of statistics relevant to the data set and subsequent analysis; second, a plot showing maximum, minimum and mean water levels and selected percentiles on a calendar day basis during the operating season; and third, a plot comparing the winter and summer mean water levels to the total observed range, for each year of record.

Interpretations of the plots and available historical information are also included.

RÉSUMÉ

Présentation des statistiques et études sur le niveau d'eau de vingt-sept lacs en Alberta. Les lacs choisis pour ce rapport étaient actifs en 1986 et des données les concernant ont été enregistrées pendant un minimum de 10 ans consécutifs.

Ce rapport fait état de la variation et de la durée des niveaux d'eau sur une base quotidienne et saisonnière. Il constitue un niveau d'eau extraordinairement élevés ou bas et à déterminer des changements à long terme dans ce domaine.

Les niveaux d'eau historiques sont indiqués sous trois formes: premièrement, une liste de statistiques pertinentes à l'ensemble de données et une analyse subséquente; deuxièmement, un diagramme montrant les niveaux d'eau maximums, minimums et moyens et des pourcentiles choisis sur une base de calendrier quotidien pendant la saison des opérations; troisièmement, un diagramme comparant les niveaux d'eau moyens en hiver et en été avec la variation totale étudiée, pour chaque année de données enregistrées.

Les interprétations de ces diagrammes et l'information historique disponible font également partie de ce rapport.

1.0 INTRODUCTION

This report provides information on fifteen unregulated lakes in Alberta which have a minimum of 10 years of record to 1986. In addition, twelve regulated lakes of special interest have also been included. Historical water levels are shown in three formats: first, a listing of statistics relevant to the data set and the subsequent analysis; second, a plot showing selected percentiles of the daily water levels and the maximum, minimum, and mean daily water levels during the operating season of the gauge; and third, a plot comparing the winter and summer mean water levels to the total observed range, for each year of record. Interpretations of the plots and available historical information are also provided.

1.1 THE DATA SET

The data set contains daily values which may be daily means or instantaneous values, depending on the frequency of observation. The observation frequency at the selected sites varied from as few as one or two observations per year to

continuous strip-chart recording. As well, the record may have been obtained on an annual basis, from January 01 to December 31, or on a seasonal basis, which is generally from May 01 to October 31, but may begin as early as March 01.

Since manual gauge observations are often made on a weekly or monthly basis there are many gaps in the record. To produce a continuous trace on the percentile plot it was necessary to have data points for each day of the season. Linear interpolations were applied to periods with gaps in the record. Interpolation was allowed with 30 days between readings for the winter months (Nov-Apr) and with 10 days between readings during the summer season (May-Oct); some flexibility was tolerated.

The computation period was selected to facilitate derivation of the percentiles and may not be the same as the total period of record. The total period of record may also contain gaps in the annual series, yet only consecutive years were allowed. The computation period was also restricted to unregulated periods or to periods that had the same regulatory practice. Finally, the record collection could have changed from a seasonal to an annual basis, or to a season of a different duration. It was necessary that the successive annual hydrographs that were used to construct the percentile plot each have the same beginning and end dates; therefore, the computation periods were chosen accordingly.

1.2 THE ANALYSIS

1.2.1 The Table of Statistics

The following statistics are listed for each lake: the name of the lake, the Water Survey of Canada (WSC) station number, the gauge location, the drainage area to the outlet, the computation period used for the percentile plot, and, relative to the computation period, the maximum and minimum water levels and their respective dates of occurrence, the mean summer and winter water levels, the standard deviation of the winter and summer values, the overall mean, and a listing of the percent recorded, percent missing and percent estimated data. Finally, for the entire period of record the dates and values of the historical minimum and maximum water levels are presented.

1.2.2 The Percentile Plot

The plot labeled "Percentiles of Water Levels" shows the distribution of the sample of water levels for each calendar day during the computation period.

For each lake, the minimum, maximum, and mean water levels for each calendar day were plotted. Generally, only two or three of the percentiles were included on the plot. Choice of the number and the value of the percentiles presented depended on the scale and range of the water levels.

1.2.3 Variation of Seasonal Mean Water Levels

This plot provides information necessary for interpretation of the percentiles of water levels. Trends toward higher or lower water levels become apparent, as does the occurrence of extraordinarily high or low water levels. Significant changes in regulation practice also show up on this plot.

The first step in generating the plot is to put the seasonal mean values through the following transformation:

$$\text{Transformed Seasonal Mean Water Level} = \frac{(\text{Seasonal Mean} - \text{Historical Minimum}) \times 100\%}{\text{Total Range}}$$

This value is then plotted on a time scale at the mid-point of each respective season: June 01 for summer values and December 01 for winter values. Transformed summer mean values are plotted as the locus of the individual values. Winter values are plotted as points.

1.2.4 Background and Interpretations

Background information for each of the selected gauge sites as well as qualitative interpretations of the data provided are included adjacent to the plots.

2.0 SELECTED ALBERTA LAKES

2.1 STATION: BAPTISTE LAKE NEAR ATHABASCA NO: 07BE002

This lake is located approximately 135 km north of Edmonton. During the 15 year period of record, water level observations at this site were recorded by a local observer. These observations were made on a daily basis during the open water season from May to October. During this period the total observed range was 1.274 meters.

The maximum water level line on the percentile plot shows three distinct peaks. From left to right these represent water levels that occurred during 1974, 1983, and 1978. Comparing the maximum water level line to the percentiles indicates that the April 1974 and October 1978 peaks were extraordinarily high water levels for those months. In both cases the 80th percentiles are much closer to the minimum values than they are to the maximum values. For this reason, the July 1983 peak is also considered extraordinary. The fact that all the other lines also peak in July is, in this case, indicative of the normal seasonal variation in water level and not due to this single event.

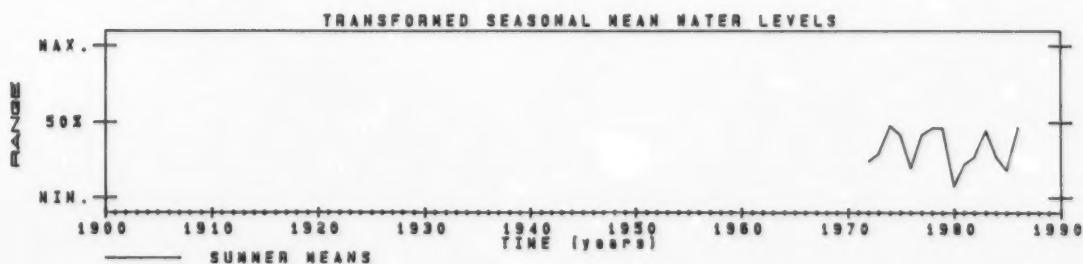
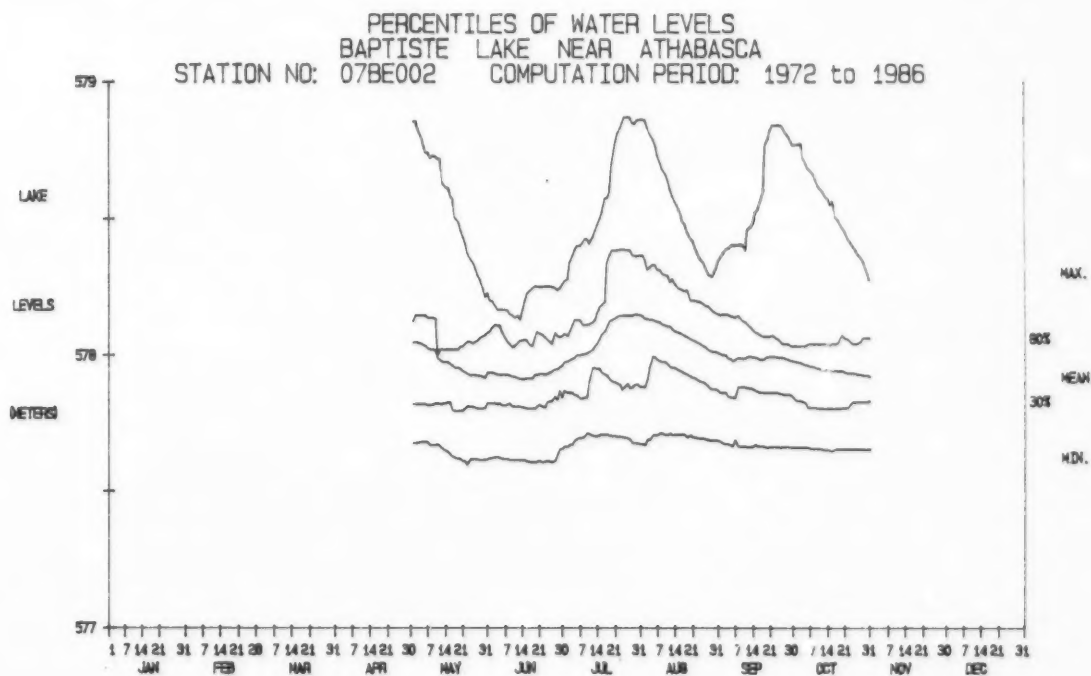
The plot of the transformed seasonal mean water levels shows no trend over the period of record. The transformed summer mean water levels all plot in the bottom half of the range, indicating that the total observed range is approximately twice the normal summer range.

BAPTISTE LAKE NEAR ATHABASCA - 07BE002

1972 TO 1986

Data Set Statistics
=====

Overall Mean	:	577.997 m	Drainage area	:	303 km ²
Summer Mean	:	577.997 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.238 m	Gauge location - latitude:	:	54° 44' 14" N
Standard deviation - Winter	:	N/A	longitude:	:	113° 31' 51" W
Computation period max. level:	:	578.870 m	Percent of recorded data:	:	94.1 %
Date of computation period max:	:	JUL 25, 1986	Percent of estimated data:	:	4.3 %
Computation period min. level:	:	577.596 m	Percent of missing data:	:	1.6 %
Date of computation period min:	:	MAY 23, 1980			
Historical maximum water level:	:	578.870 m	Gauge datum	:	Approximate
Date of historical maximum:	:	JUL 25, 1986		:	Geodetic Survey
Historical minimum water level:	:	577.596 m		:	of Canada Datum
Date of historical minimum:	:	MAY 23, 1980			



2.2 STATION: BEAR LAKE NEAR CLAIRMONT
NO: 07GE004

Bear Lake is located approximately 15 km north-west of Grande Prairie. Until the spring of 1986 the towns of Grande Prairie and Clairmont used this lake for their municipal water supplies. Water levels have been maintained by a dam at the outlet to the Bear River. No efforts are presently being made to regulate the water level, however, the dam is still in place.

The water level at this site has been monitored since the summer of 1969. During 1969 and 1970 the gauge readings were made monthly. From 1971 to 1975 readings were made two to three times a week and since 1976 daily readings have been made. Water levels were originally recorded for the open water season from May to October, however, from 1982 to 1986 the water levels have been recorded continuously from January to December.

Monthly values are not frequent enough to be included in the computations for the percentiles, therefore the data for the years 1969 and 1970 were not included. The monthly observations of 1969 and 1970 did not indicate extraordinarily high or low water levels relative to the total period.

For the period of record, observations show that the lake has experienced a 2.90 meter range in water level. The most that this lake has been observed to change in any one year was 2.64 meters in 1964, and the least was 0.25 meters in 1980. For most years the summer range varies between 0.5 and 1.0 meters.

The maximum water level line on the percentile plot shows three distinct peaks: from left to right these peaks represent water levels from the 1974, 1972, and 1976 seasons. The minimum water level line represents data from 1980.

Water levels tend to be highest at the beginning of the observation season, in May and June, and decrease toward the end of the season, in October.

Throughout the summer season the percentiles tend to be skewed towards the minimum, indicating that the observed peaks of 1972, 1974, and 1976 were abnormal for this 16 year period.

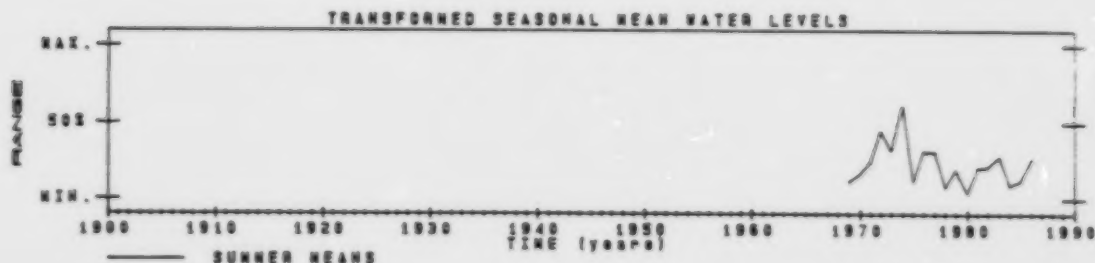
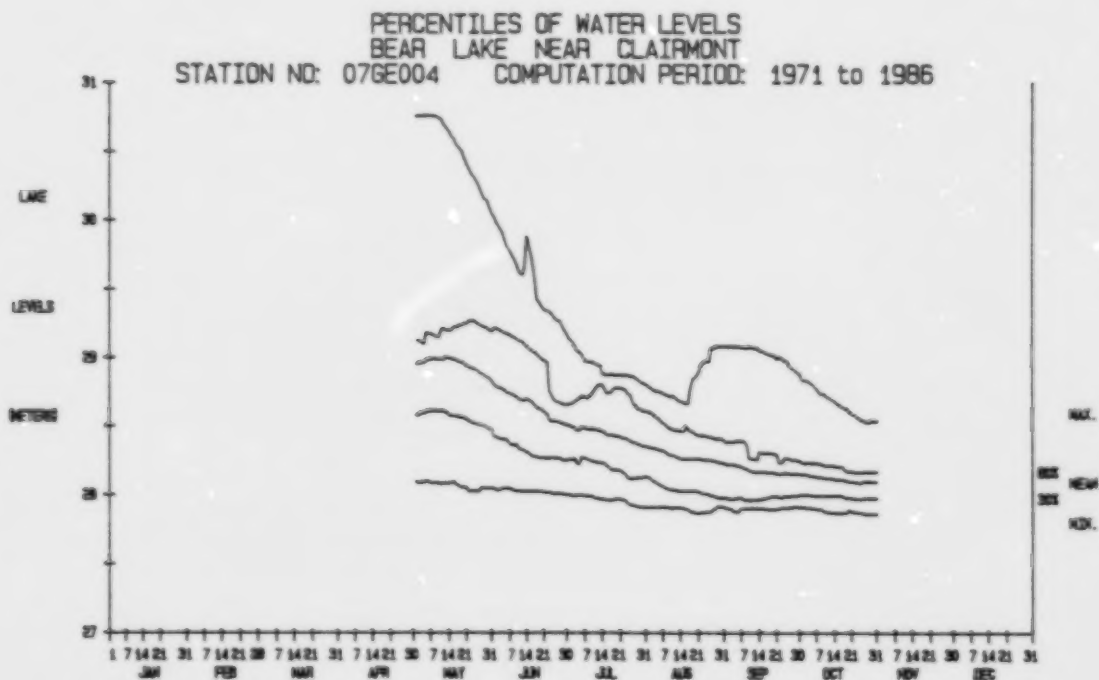
The bottom plot shows that, except for 1974, all of the transformed seasonal mean water levels plot in the lower half of the range. This is a further indication that the 1974 peak was abnormally high. Apart from this one irregularity the seasonal values show close grouping. No trend toward higher or lower water levels is indicated.

BEAR LAKE NEAR CLAIRMONT - 07GE004

1971 TO 1986

Data Set Statistics

Overall Mean	:	28.442 m	Drainage area	:	1190 km ²
Summer Mean	:	28.442 m	Regulation	:	Prior To Computation Period
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.490 m	Gauge location - latitude:	:	55° 16' 10" N
Standard deviation - Winter	:	N/A	longitude:	:	118° 58' 30" W
Computation period max. level:	:	30.760 m	Percent of recorded data:	:	63.8 %
Date of computation period max:	:	MAY 1, 1974	Percent of estimated data:	:	30.8 %
Computation period min. level:	:	27.860 m	Percent of missing data:	:	6.1 %
Date of computation period min:	:	OCT 26, 1980			
Historical maximum water level:	:	30.760 m	Gauge datum	:	Arbitrarily Assumed
Date of historical maximum:	:	MAY 8, 1974			
Historical minimum water level:	:	27.860 m			
Date of historical minimum:	:	OCT 26, 1980			



2.3 STATION: BEAVER LAKE AT RANGER STATION
NO: 06AA003

This lake is located near the town of Lac La Biche, approximately 174 km north-east of Edmonton. Water levels at this site have been recorded by a variety of local observers during the 15 year period of record. Observations are made from May to October with measurement frequencies ranging from 3 or 4 times a month to daily readings. During this period the water level of Beaver Lake was observed to vary over a range of approximately one meter.

The abrupt jumps in the traces shown on the percentile plot are due to gaps in the record, ie. at these locations the amount of time between readings was too great for linear interpolation.

The percentile plot for this lake shows that the distribution of the observed daily water levels is skewed toward the maximum values. Throughout the season the mean water level is always less than the 50th percentile and the departure of the 30th percentile from the minimum water level is approximately the same as the departure of the 50th percentile from the maximum water level. Generally, 50% of the daily values occur in the top third of the range and 30% of the daily values occur in the bottom third of the range.

The plot of the transformed summer mean water levels shows relatively high summer mean water levels from 1972 to 1979 followed by a steady lowering of the water level to 1986. This abrupt downturn of the transformed mean water level line is partly a function of scale. This graph shows relative changes with respect to maximum and minimum observed values; if these values are close to the same quantity, then the effect is exaggerated. Nevertheless, a steady decline in water level since 1979 is apparent. Similar declines in the water level for this period of time are also evident in other lakes in east central Alberta, such as Calling Lake and Cold Lake.

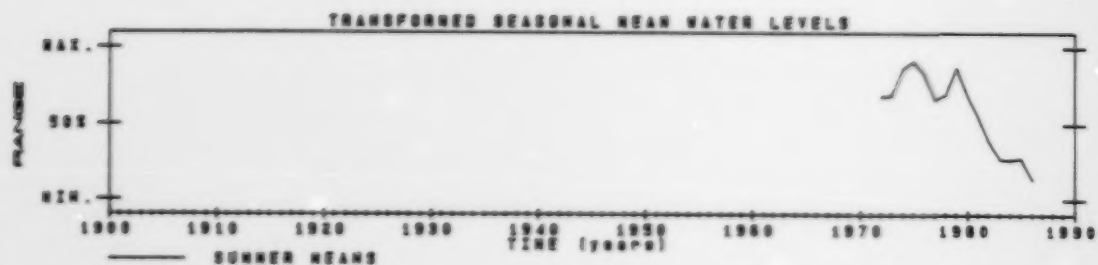
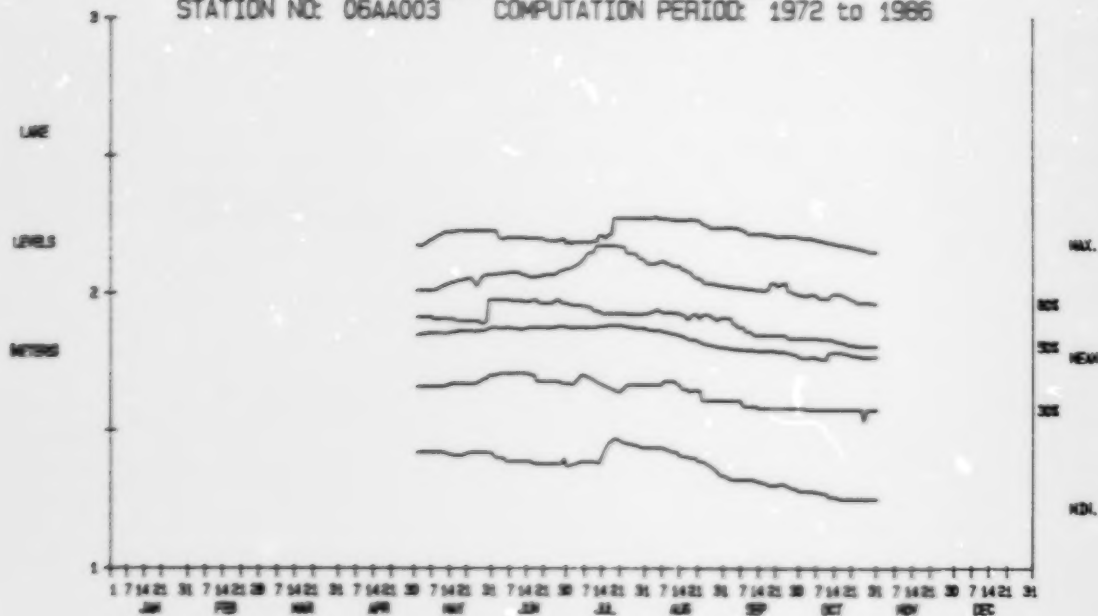
BEAVER LAKE AT RANGER STATION - 06AA003

1972 TO 1986

Data Set Statistics

Overall Mean	:	1.836 m	Drainage area	:	331 km ²
Summer Mean	:	1.836 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.259 m	Gauge location - latitude:	:	54° 45' 40" N
Standard deviation - Winter	:	N/A	longitude:	:	111° 54' 05" W
Computation period max. level :		2.277 m	Percent of recorded data :		71.8 %
Date of computation period max:	AUG 5, 1975		Percent of estimated data:		27.5 %
Computation period min. level :		1.250 m	Percent of missing data :		0.7 %
Date of computation period min:	OCT 16, 1986				
Historical maximum water level:		2.277 m	Gauge datum	:	Arbitrarily Assumed
Date of historical maximum :	AUG 5, 1975				
Historical minimum water level:		1.250 m			
Date of historical minimum :	OCT 16, 1986				

PERCENTILES OF WATER LEVELS
BEAVER LAKE AT RANGER STATION
STATION NO: 06AA003 COMPUTATION PERIOD: 1972 to 1986



**2.4 STATION: BUFFALO LAKE NEAR ERSKINE
NO: 05CD005**

Buffalo Lake is located 120 km south of Edmonton and 55 km east of Lacombe. Since 1965, local observers have recorded gauge readings at this site for the April to October season. From 1965 to 1970 water level observations at Buffalo Lake were made monthly; from 1971 to 1973, daily observations were made; from 1974 to 1986, observations have been made every two to three days.

For the open water season one reading per month is not frequent enough for inclusion in the percentile computation; it was not until 1971 that the frequency of observation became high enough for a percentile plot to be produced. However, during the analysis it became apparent that all of the recorded extreme minimum values occurred in 1968; therefore, to provide a better indication of the observed range, data from the monthly observations of 1968 have been used to construct the dotted line shown on the percentile plot.

The inclusion of the minimum values that occurred prior to 1971 is important. The daily frequency distributions from 1971 to 1985 appear bell-shaped, yet distinctly skewed toward the minimum water level. When the 1968 miscellaneous water levels are included the shape of the daily frequency distributions becomes skewed toward the maximum water level.

During the 16 year period for which the percentile plot was produced, the lake experienced a range in water level of 1.353 meters. The recorded range in water level since 1965 is 1.713 meters.

The plot of the transformed summer mean water levels indicates a steady increase in water level from 1968 to 1974, followed by a steady decline in water level to 1986. The abrupt variations are partially a function of scale. This plot shows relative changes with respect to maximum and minimum observed values. If these values are close to the same quantity, then the variation is exaggerated. The plot for Buffalo Lake indicates that no short duration peak water levels have been experienced. Short duration peaks would result from intense precipitation events, rapid snow melt, or both and would generally cause the transformed mean summer water levels to plot in the bottom half of the range rather than throughout the full range of values.

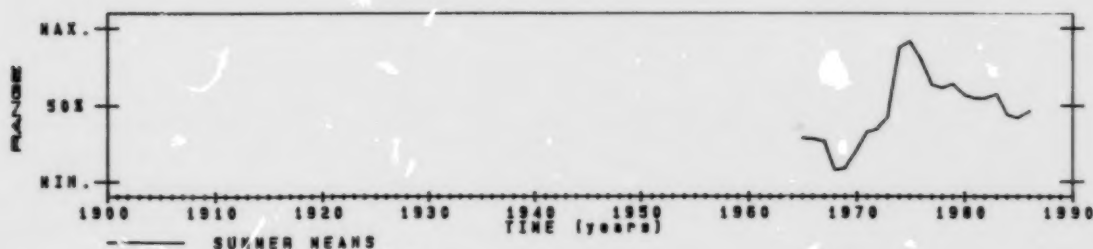
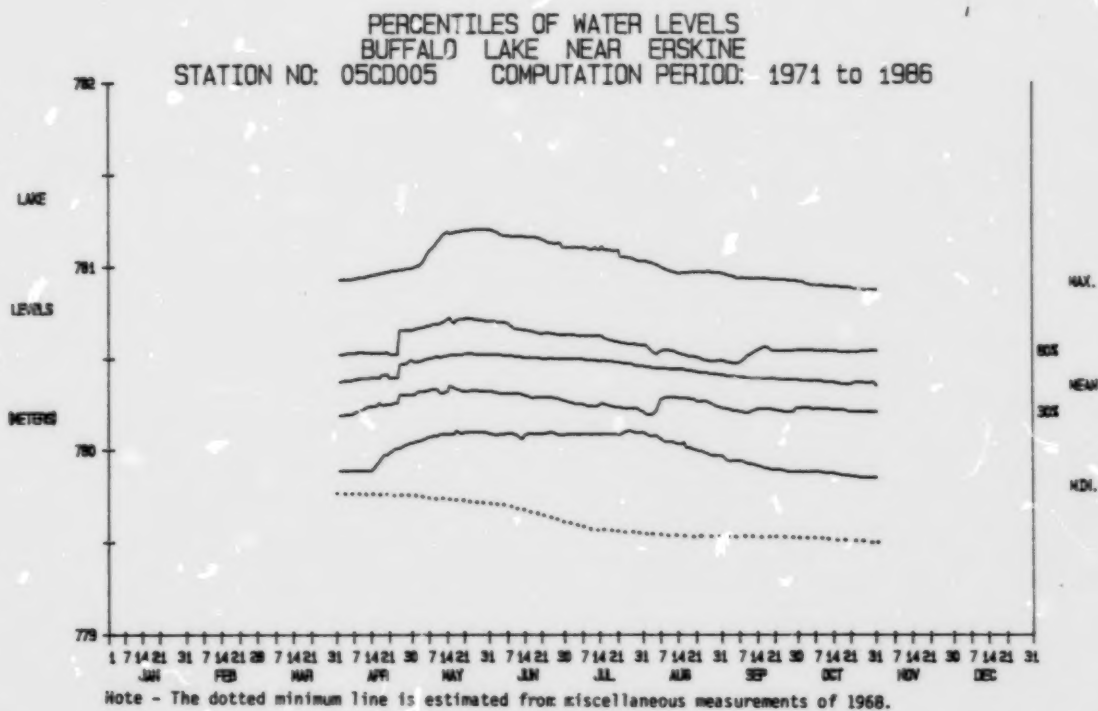
The 1974 and 1975 peaks as shown are similar to the peaks on the plot for Sylvan Lake.

BUFFALO LAKE NEAR ERSKINE - 05CD005

1971 TO 1986

Data Set Statistics

Overall Mean	:	780.451 m	Drainage area	:	1570 km ²
Summer Mean	:	786.450 m	Regulation	:	Prior To Computation Period
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.297 m	Gauge location - latitude:	:	52° 27' 53" N
Standard deviation - Winter	:	N/A	longitude:	:	112° 52' 57" W
Computation period max. level:	:	781.205 m	Percent of recorded data:	:	36.0 %
Date of computation period max:	:	MAY 28, 1975	Percent of estimated data:	:	58.8 %
Computation period min. level:	:	779.852 m	Percent of missing data:	:	5.2 %
Date of computation period min:	:	OCT 25, 1971			
Historical maximum water level:	:	781.205 m	Gauge datum	:	Geodetic Survey of Canada Datum
Date of historical maximum:	:	MAY 28, 1975			
Historical minimum water level:	:	779.492 m			
Date of historical minimum:	:	OCT 31, 1968			



2.5 STATION: CALLING LAKE AT RANGER STATION
NO: 07CB001

Calling Lake is located 190 km north of Edmonton. Water levels have been recorded by a variety of observers over the 17 year history of record at this site. The frequency of observation has ranged from one to three times a week in 1970 and 1971 to daily readings thereafter. Readings are made during the open water season from April to October.

Generally, this lake is not effected by spring runoff until late June through August. The highest mean seasonal water level on record was observed during 1970, which is also the first year of record. An above average spring water level, from snowmelt followed by heavy rainfall in late June, resulted in the high lake level which lasted throughout the season. On the percentile plot an abrupt increase in the maximum water level at the end of June is due to this 1970 event. Prior to June 30 the maximum water level line represents the 1974 water level. For many gauge sites in east central Alberta, 1974 was the highest water level in the last two decades; in all cases the 1974 peak was due to snowmelt and occurred in April and May.

The second plot shows the transformed summer mean water levels for each year of record. For Calling Lake each of these values plot in the bottom half of the range. This indicates that the peak water level that was observed during the first year of record was approximately twice as high as the normal range. This plot also shows that the transformed summer mean water levels are trending toward lower values. Similar declines in recent water levels have been observed in lakes throughout Alberta, notably in nearby Lac La Biche and in Fawcett Lake.

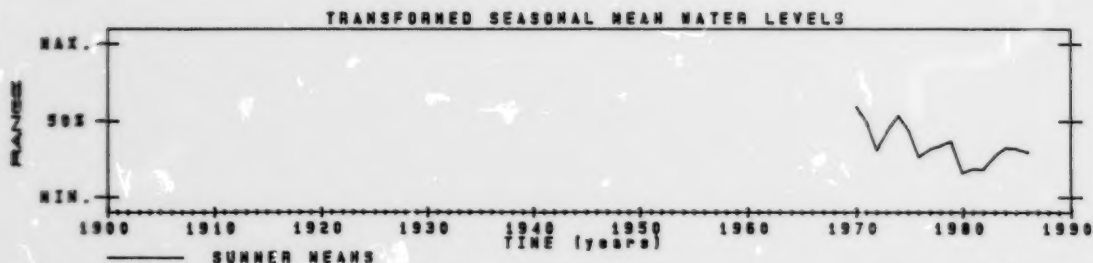
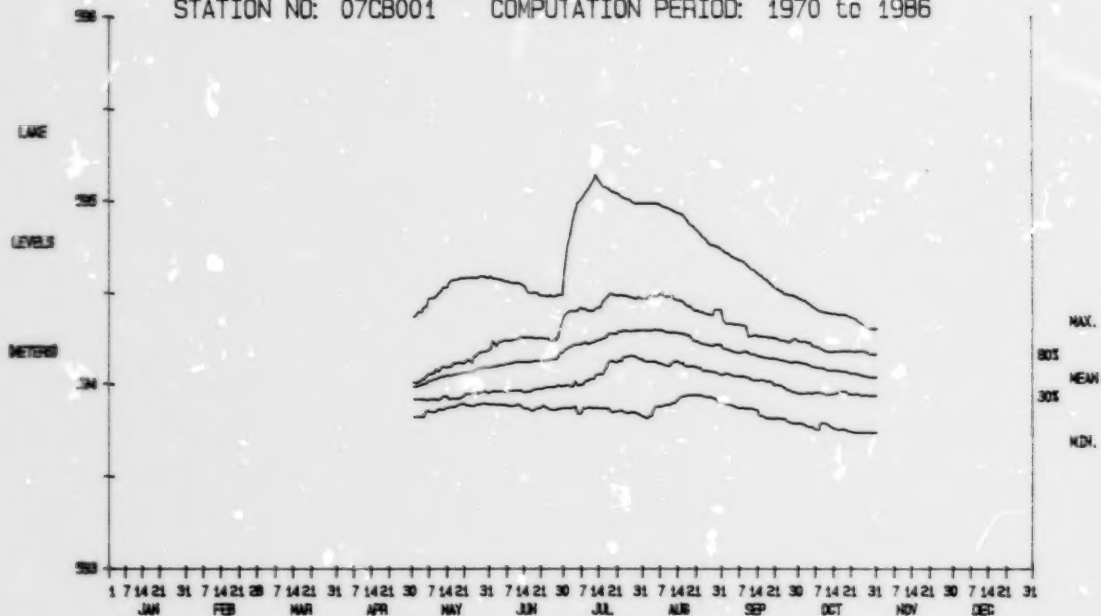
CALLING LAKE AT RANGER STATION - 07CB001

1970 TO 1986

Data Set Statistics

Overall Mean	:	594.156 m	Drainage area	:	1220 km ²
Summer Mean	:	594.156 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.223 m	Gauge location - latitude:	:	55° 13' 35" N
Standard deviation - Winter	:	N/A	longitude:	:	113° 12' 05" W
Computation period max. level:	:	595.140 m	Percent of recorded data:	:	89.5 %
Date of computation period max:	:	JUL 13, 1970	Percent of estimated data:	:	7.1 %
Computation period min. level:	:	593.742 m	Percent of missing data:	:	3.4 %
Date of computation period min:	:	OCT 22, 1981			
Historical maximum water level:	:	595.140 m	Gauge datum	:	Approximate
Date of historical maximum:	:	JUL 13, 1970			Geodetic Survey
Historical minimum water level:	:	593.673 m			of Canada Datum
Date of historical minimum:	:	APR 22, 1981			

PERCENTILES OF WATER LEVELS
CALLING LAKE AT RANGER STATION
STATION NO: 07CB001 COMPUTATION PERIOD: 1970 to 1986



**2.6 STATION: CHIP LAKE AT OUTLET TO LOBSTICK RIVER
NO: 07BB008**

Chip Lake is located 130 km west of Edmonton. During the 15 year history of observations at this site the water level data were recorded on a daily basis by a local observer.

Prior to 1983 the water levels were measured at a site approximately 0.5 km downstream of the outlet on the Lobstick River and converted to a lake level using a slope correction. Data for 1983 to 1986 was observed at the actual outlet of the lake.

The maximum observed water level line shown on the percentile plot is made up of four different years of record. From the first of May to early June maximum water levels are from the 1974 season. The melting of a heavy snowpack that had accumulated during the previous winter contributed to the abnormally high water levels at this and many other lakes in east-central Alberta at that time. The spike that appears during the last week in July was caused by an intense rainfall event in 1986. This event caused the lake level to increase 1.4 meters in 10 days. Apart from this spike the maximum water level from mid-June to mid-September corresponds to the 1980 season. The remainder of this line represents data from 1977.

The minimum water level line is a composite of water levels from the 1982, 1983, and 1984 seasons.

In general the frequency distributions of daily water levels are skewed towards the minimum. As well, the departure of the maximum water level line from the 80th percentile is greater throughout the season than the relative departures of the 30th and 80th percentiles from the mean water level. These are indications that the high water levels are abnormal relative to this short period of record.

It is usually the case for lakes with only 5.0% of the data missing that the percentile plot shows smooth traces, unlike that determined for Chip Lake. The jagged lines on the percentile plot are most likely due to the observation method since the relationship between water levels 0.5 km downstream on the Lobstick River and the water levels at the outlet was not well defined. The gauge record at this location is also effected by strong winds and ice jams causing rapid changes in the water level.

The second plot shows the transformed summer mean water levels for each year of record. For Chip Lake this graph shows that the transformed summer mean water levels rarely exceed 60% of the observed range, indicating that at least one short duration high water level has occurred. No trend toward higher or lower water levels is apparent.

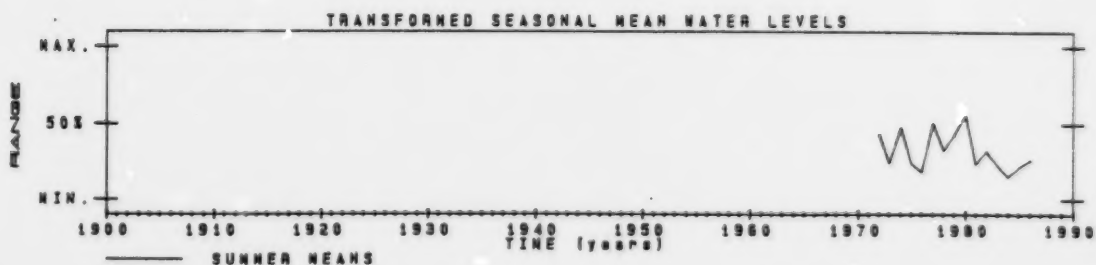
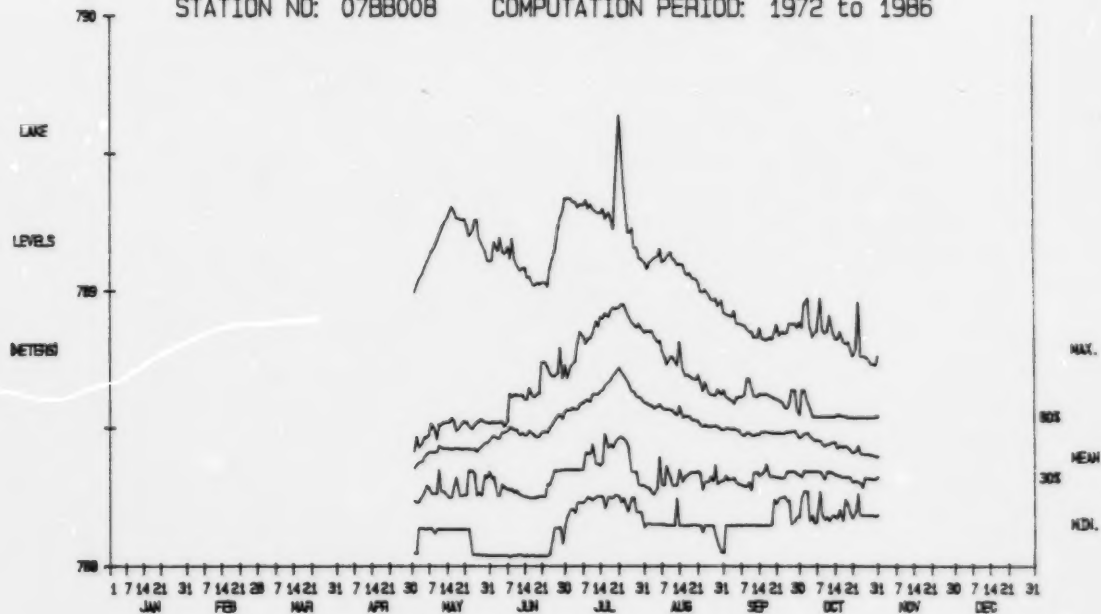
CHIP LAKE AT OUTLET TO LOBSTICK RIVER - 07BB008

1972 TO 1986

Data Set Statistics
=====

Overall Mean	:	788.503 m	Drainage area	:	1210 km ²
Summer Mean	:	788.503 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.267 m	Gauge location - latitude:	:	53° 36' 54" N
Standard deviation - Winter	:	N/A	longitude:	:	115° 15' 33" W
Computation period max. level:	:	789.640 m	Percent of recorded data:	:	89.9 %
Date of computation period max:	:	JUL 21, 1986	Percent of estimated data:	:	5.1 %
Computation period min. level:	:	788.029 m	Percent of missing data:	:	5.0 %
Date of computation period min:	:	JUN 8, 1983			
Historical maximum water level:	:	789.640 m	Gauge datum	:	Approximate
Date of historical maximum:	:	JUL 21, 1986		:	Geodetic Survey
Historical minimum water level:	:	787.990 m		:	of Canada Datum
Date of historical minimum:	:	APR 16, 1982			

PERCENTILES OF WATER LEVELS
CHIP LAKE AT OUTLET TO LOBSTICK RIVER
STATION NO: 07BB008 COMPUTATION PERIOD: 1972 to 1986



2.7 STATION: COLD LAKE AT COLD LAKE
NO: 06AF002

Cold Lake is located on the Alberta-Saskatchewan boundary, 240 km east-north-east of Edmonton. The water level at this site has been monitored since October of 1954. Prior to September 1981, readings were taken 2 to 3 times a week 12 months a year; after that time a recording gauge was established to provide continuous record.

Throughout the history of gauge record at this site, the lake has been observed to fluctuate over a range of 1.229 meters.

The maximum water level line as shown on the percentile plot results from a compilation of 3 separate years, from left to right: February to June, 1974; June to August 1965; and, August to December, 1960.

The minimum water level line on this plot represents 1968 from January 01 to the end of September; October and November values are from 1981; December values are from 1967.

For the period of record shown on the percentile plot the relative departures of the maximum values from the 80th percentiles and the minimum values from the 30th percentiles are greater than the distance between the 30th and 80th percentiles themselves. This indicates bell-shaped distributions. As well, the 60th percentiles plot close to the mean water levels for most of the year. This indicates that the median values are closer to the minimum than the maximum, i.e., the frequency distributions for the daily water levels are skewed toward the minimum.

The plot of transformed seasonal mean water levels shows that the mean summer and winter water levels are spread over 80% of the total observed range and indicates that short duration extraordinarily high or low water levels have not yet been observed. Additionally, the plot shows a steady decline in water level since 1974.

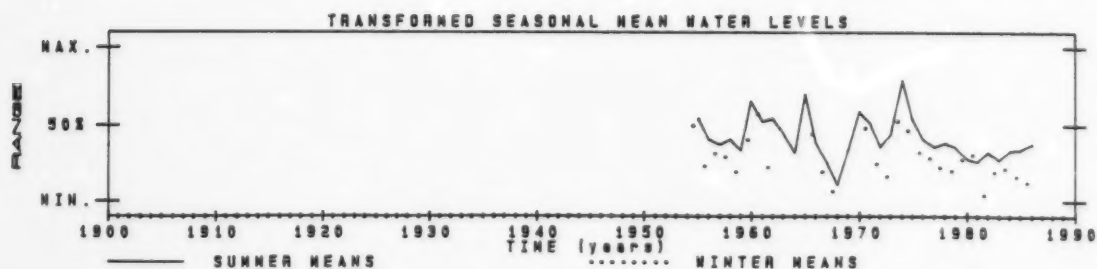
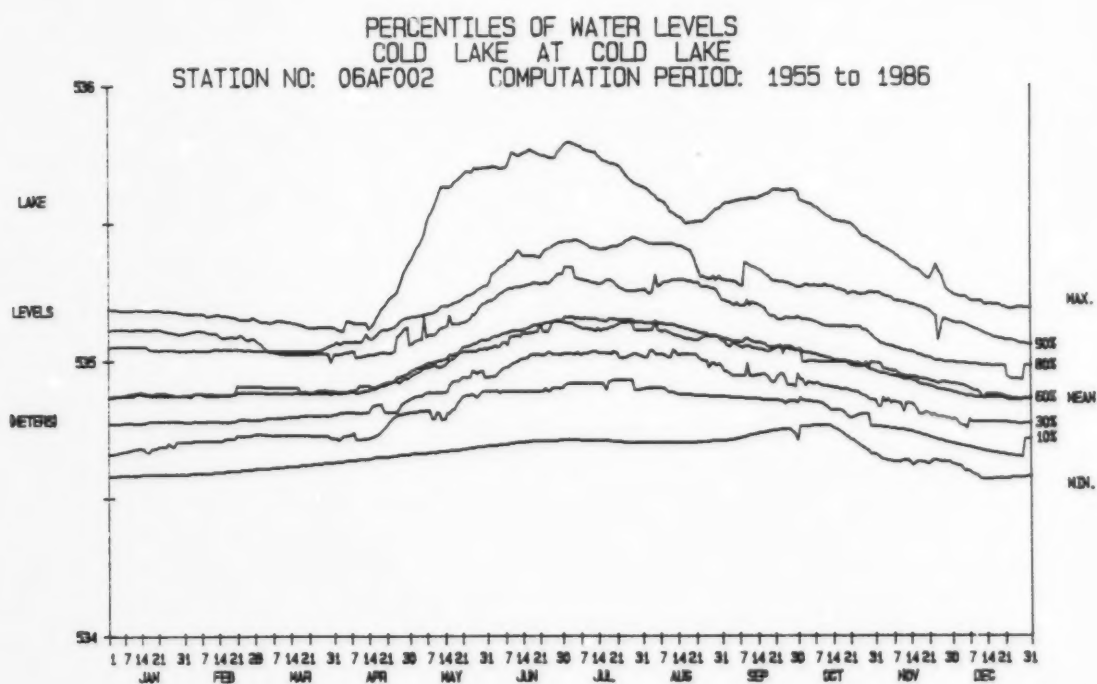
Cold Lake is subject to consumptive demands which may have a minor effect on the lake level. Esso Resources constructed a steam generating plant which began operation in January of 1984. In 1984 and 1985 the plant utilized 2 322 000 m³ and 4 197 000 m³ respectively. The projected demand for the period from 1986 to 1991 is 6 500 000 m³ annually. Present plans are to move the plant to a new water source after 1991.

COLD LAKE AT COLD LAKE - 06AF002

1955 TO 1986

Data Set Statistics

Overall Mean	:	534.996 m	Drainage area	:	6510 km ²
Summer Mean	:	535.077 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	534.890 m			
Standard deviation - Summer	:	0.206 m	Gauge location - latitude:	:	54° 28' 15" N
Standard deviation - Winter	:	0.151 m	longitude:	:	110° 10' 55" W
Computation period max. level:	:	535.796 m	Percent of recorded data:	:	39.4 %
Date of computation period max:	:	JUL 2, 1965	Percent of estimated data:	:	50.2 %
Computation period min. level:	:	534.567 m	Percent of missing data:	:	10.4 %
Date of computation period min:	:	DEC 12, 1967			
Historical maximum water level:	:	535.796 m	Gauge datum	:	Approximate
Date of historical maximum:	:	JUL 2, 1965		:	Geodetic Survey
Historical minimum water level:	:	534.567 m		:	of Canada Datum
Date of historical minimum:	:	DEC 12, 1967			



2.8 STATION: COOKING LAKE AT COOKING LAKE
NO: 05EB012

Cooking Lake is located 30 km south-east of Edmonton. Water level data for this lake have been recorded over several periods. From 1919 to 1920 and again from 1939 to 1941, water levels were determined 2-3 times a week by a local observer who read a staff gauge at the north end of the lake. During times of high water daily observations were made. When monitoring of the water levels was re-established in 1972, the gauging site was moved to the far south-east end of the lake, a distance of approximately 12 km. Since that time a local observer has taken daily readings.

The maximum water level line represents data from the 1975 season from May to early July and from the 1974 season for the remainder of the year. The minimum water level line represents 1973 values to mid-June and 1972 values for the rest of the year.

The erratic trace of the percentile plot is primarily due to low measurement frequency. The true maximum water level would be better represented by connecting the peaks (ie., further interpolations).

The total observed range in lake level for the period of record is 0.805 meters. The percentile plot indicates much fluctuation over this range. These fluctuations are expected to be attenuated as the period of record is lengthened.

The level of this lake is effected by beaver activity. Periodically the beaver dams are removed causing sudden drops in the water level.

The relative spacings of the percentiles indicates that the sample of daily values is skewed toward the maximum. Frequency distributions skewed toward the maximum are rare in hydrology and are almost always due to man's interference (in this case, the removal of the beaver dams). The constant competition between the beavers building dams and the humans taking them out makes it difficult to determine the natural condition.

The comparison of transformed seasonal mean water levels for the period of record shows no trend toward higher or lower values.

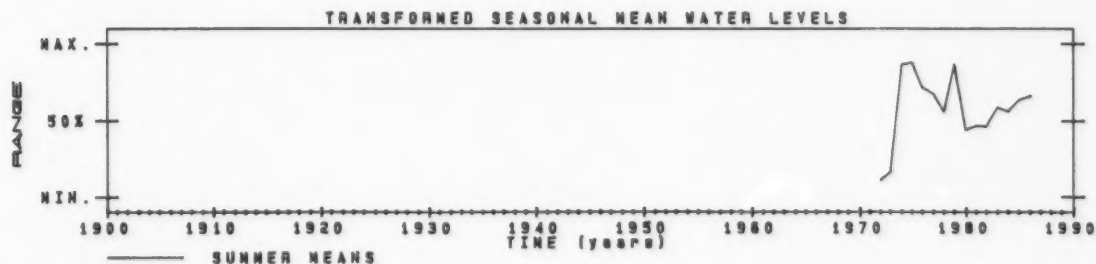
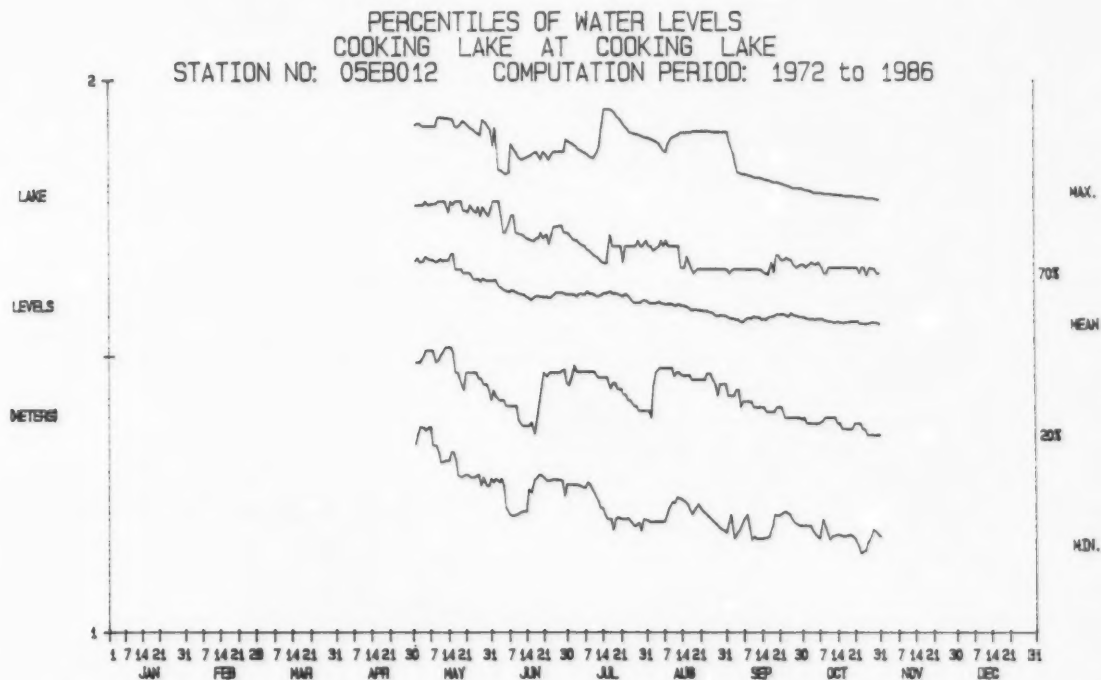
For similar lakes compare Hastings and Miquelon.

COOKING LAKE AT COOKING LAKE - 05EB012

1972 TO 1986

Data Set Statistics

Overall Mean	:	1.589 m	Drainage area	:	196 km ²
Summer Mean	:	1.589 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.184 m	Gauge location - latitude:	:	53° 24' 59" N
Standard deviation - Winter	:	N/A	longitude:	:	113° 07' 15" W
Computation period max. level :		1.948 m	Percent of recorded data :		73.7 %
Date of computation period max:		JUL 15, 1974	Percent of estimated data:		16.3 %
Computation period min. level :		1.143 m	Percent of missing data :		10.0 %
Date of computation period min:		OCT 23, 1972			
Historical maximum water level:		1.948 m	Gauge datum	:	Arbitrarily Assumed
Date of historical maximum :		JUL 15, 1974			
Historical minimum water level:		1.143 m			
Date of historical minimum :		OCT 23, 1972			



2.9 STATION: ELKWATER LAKE AT ELKWATER
NO: 05AH025

Elkwater Lake is located near the Cypress Hills in the extreme south-east corner of Alberta. The water level for this lake is regulated at the outlet to Ross Creek by an earth-fill dam. The dam was originally constructed in the 1920's and rebuilt in 1978.

Water level data for Elkwater Lake has been collected at this site during the May to October season for various periods of record. From 1917 to 1931 and again in 1940, monthly water level readings were made. In 1953 some miscellaneous readings were made. From 1962 to 1970 a local observer took readings 1 to 4 times a month. From 1971 to 1986 the frequency of observations was increased to once a day.

Water level readings to 1940 are relative to an assumed datum. Since 1953, water levels are relative to the Geodetic Survey of Canada (G.S.C.) datum. This datum has not been tied to the earlier assumed datum. Consequently, current values cannot be compared to water level readings from 1940 and earlier.

Prior to 1971 the frequency of observation was too low for inclusion in the calculation of the percentiles. The recorded range in water level is 1.43 meters. For the computation period from 1971 to 1986 the observed range is 0.98 meters. Since there is a significant difference between the range for the computation period and the total period of record, a dotted line representing water level values from the 1962 and 1963 season, has been included on the percentile plot to better indicate the range in observed values.

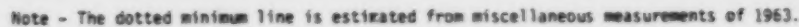
The maximum water level line on the percentile plot represents water levels that occurred in the 1983, 1982 and 1975 seasons. The minimum water level line, for the most part, represents 1981 data.

From 1971 to 1986, the percentile plot indicates that the daily frequency distributions of water levels are bell-shaped and slightly skewed towards the maximum. Had the extreme low water levels observed in the early 1960's been included in the analysis, the daily frequency distributions would have appeared J-shaped, and would have been very highly skewed toward the maximum.

The plot of transformed seasonal mean water levels for the period of record indicates that the extreme low water was limited to the 1962, 1963, and 1964 seasons. All of the other values plot in the top half of the range. This plot also shows an increase in the variation of successive mean summer water levels since 1971. The increased variation is possibly due to the increased frequency of observation but no firm conclusions can be drawn.

1971 TO 1986

PERCENTILES OF WATER LEVELS
ELKWATER LAKE AT ELKWATER
STATION NO: 05AH025 COMPUTATION PERIOD: 1971 to 1986



2.10 STATION: FAWCETT LAKE NEAR SMITH
NO: 07BK008

Fawcett Lake is located approximately 200 km north of Edmonton and 60 km east of Lesser Slave Lake. Water levels have been recorded at this site since 1973.

The frequency of observation has varied over the years. From 1973 to 1979 a local observer made daily water level readings; from 1980 to 1982 monthly observations were made; from 1983 to 1986 water levels were monitored continuously by a strip-chart recorder. For each year of record the data has been collected from May to October.

During the summer of 1976 a sheet pile weir was constructed at the outlet of the lake to stabilize the water level. For this reason the percentile plot has only included data since 1977.

Both the extreme minimum and the extreme maximum water levels for the open water season occurred since 1977. From 1977 to 1986 the water level has experienced a range of 1.214 meters.

The maximum water level line on the percentile plot shows four distinct peaks; from left to right these peaks represent water levels for the 1985, 1977, 1983, and 1978 seasons.

The minimum water level line is composed of data from 1980 for May through to July and from 1981 for August through to October.

The gaps in the 30th and 80th percentiles are due to insufficient data.

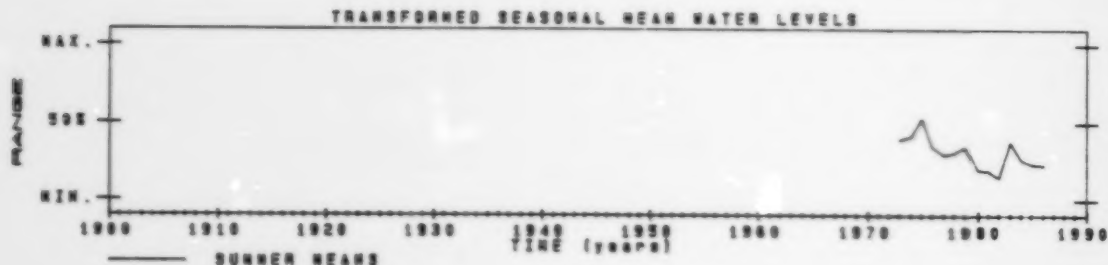
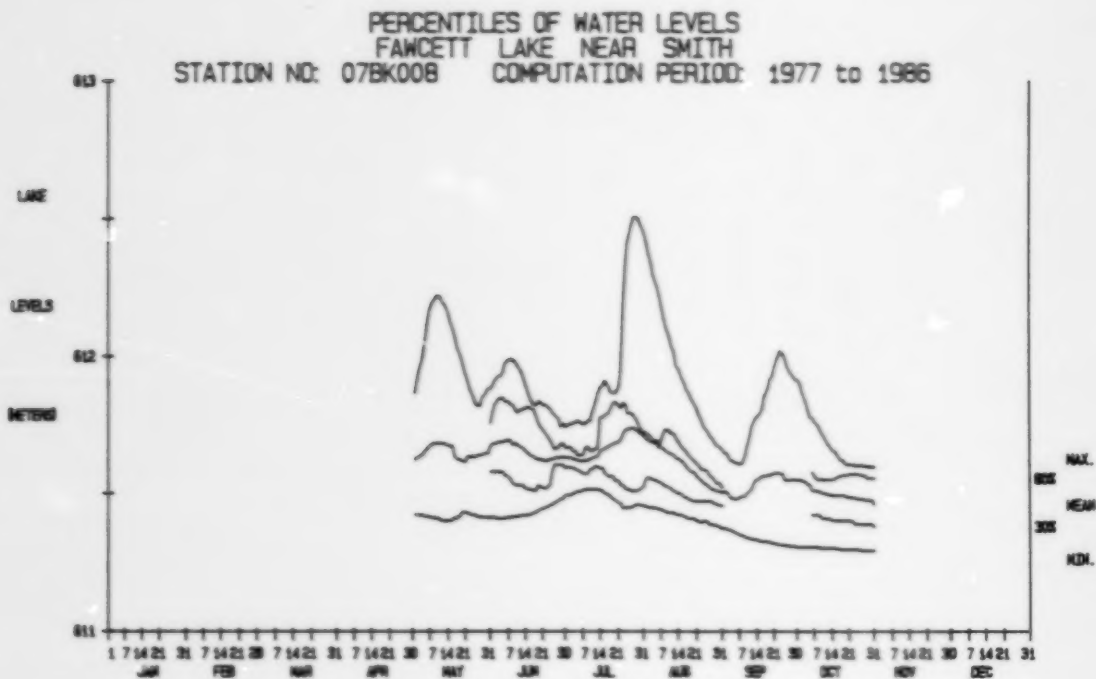
The percentile plot provides some information on the frequency distributions of water levels on a calendar day basis. In early June there appears to be a uniform distribution of water levels throughout the range. In late June the distributions of water levels appear more bell-shaped. The high water observed in July of 1983 causes the plot to be highly skewed toward the minimum for this part of the season. In late October, the distribution over the range again becomes uniform.

The plot of transformed summer mean water levels for the period of record shows that all but one of these values plot in the bottom half of the range. This indicates that the observed peaks have been of short duration relative to the summer season. This plot also shows that a lowering of the summer mean water level has been occurring since 1975.

1977 TO 1986

Data Set Statistics

Overall Mean	:	611.612 m	Drainage area	:	1240. km ²
Summer Mean	:	611.612 m	Regulation	:	Since 1976
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.174 m	Gauge location - latitude:	:	55° 18' 20" N
Standard deviation - Winter	:	N/A	longitude:	:	113° 51' 20" W
Computation period max. level :		612.508 m	Percent of recorded data :		63.9 %
Date of computation period max:		JUL 28, 1983	Percent of estimated data :		17.8 %
Computation period min. level :		611.294 m	Percent of missing data :		18.3 %
Date of computation period min:		OCT 27, 1981			
Historical maximum water level:		612.508 m	Gauge datum	:	Geodetic Survey of Canada Datum
Date of historical maximum :		JUL 28, 1983			
Historical minimum water level:		611.294 m			
Date of historical minimum :		OCT 27, 1981			



2.11 STATION: GREGOIRE LAKE NEAR FORT MCMURRAY
NO: 07CE001

Gregoire Lake is located approximately 40 km south-east of Fort McMurray. Water levels have been recorded at this site during the May to October season since 1969. Prior to 1978 water levels were usually determined once a week by a local observer; occasionally readings were made 3-4 times a week. Since 1978, a recording gauge has collected continuous data.

In 1974, a weir was installed on the outlet of the lake to control the water level. In order to maintain a homogeneous data set (ie. with respect to regulatory practices) only the water levels observed after the installation of the weir were used in the percentile plot. However, the highest observed water level occurred in 1970, prior to regulation; therefore, the observations for 1970 have been included as a dotted line on the plot, but have not been used in the calculation of the percentiles.

The peaks on the maximum water level line on the percentile plot are from several different years. From left to right these peaks represent data from the following years: 1985, 1977, 1977, and 1976. The minimum water level line represents data from 1983 for the month of May; 1981, for June, August, September and October; and 1980, for July.

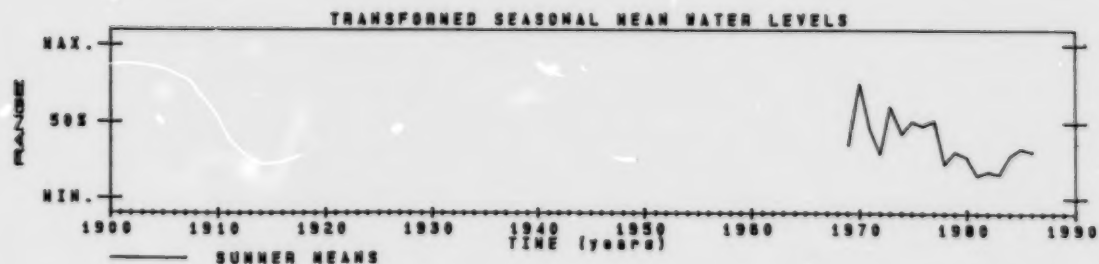
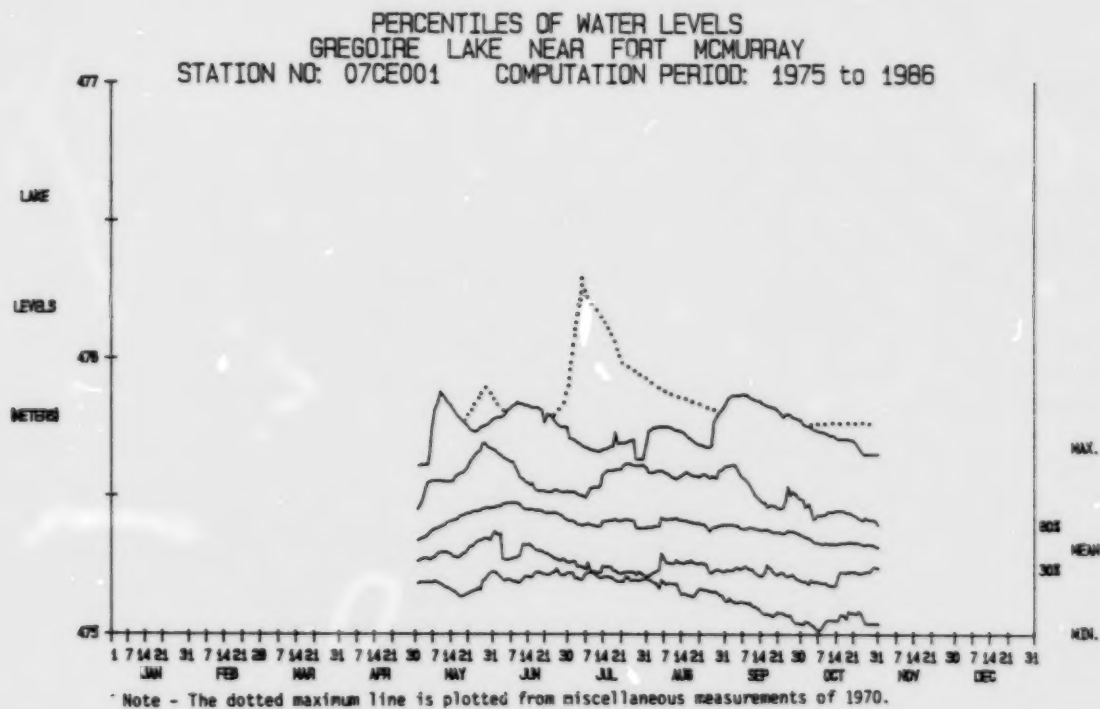
For the computation period from 1975 to 1986, the lake experienced a 0.861 meter range in water level. The fluctuation in water level during a single May to October season has ranged from as much as 0.5 m to as little as 0.3 m.

The plot of transformed seasonal mean water levels for the period of record shows that only 4 of the 18 transformed summer mean water levels are in the top half of the range and that the value for 1970 was significantly higher than the rest. This indicates that the peak water level in 1970 was abnormally high and that the lake level remained high throughout the season. This plot also shows a trend toward lower water levels since 1970.

1975 TO 1986

Data Set Statistics

Overall Mean	:	475.397 m	Drainage area	:	263 km ²
Summer Mean	:	475.397 m	Regulation	:	Since 1974
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.185 m	Gauge location - latitude:	:	56° 26' 30" N
Standard deviation - Winter	:	N/A	longitude:	:	111° 05' 10" W
Computation period max. level	:	475.875 m	Percent of recorded data	:	84.3 %
Date of computation period max	:	MAY 10, 1985	Percent of estimated data	:	8.6 %
Computation period min. level	:	475.014 m	Percent of missing data	:	7.1 %
Date of computation period min	:	OCT 7, 1981			
Historical maximum water level	:	476.290 m	Gauge datum	:	Geodetic Survey of Canada Datum
Date of historical maximum	:	JUL 5, 1970			
Historical minimum water level	:	475.014 m			
Date of historical minimum	:	OCT 7, 1981			



2.12 STATION: GULL LAKE AT ASPEN BEACH
NO: 05CC006

Gull Lake is situated approximately 20 km north of Red Deer. Since 1908, efforts have been made to increase the water level of this lake. For the period from 1976 to 1986 water was diverted to Gull Lake from the Blindman River by pumping through a pipeline during times when the flow rate in the river was high. Presently water is diverted from the Blindman River via canal.

Water level data for this lake has been collected from May to October for various periods. For the years 1924, 1938-1946, and 1953-1965, readings were made 1 to 3 times a season; from 1966 to 1969, monthly readings were made; from 1970 to 1973, 2 to 4 readings per week; for 1974 and 1975, daily readings; and from 1976 to 1986, readings were made 2 to 3 times per week.

The percentile plot has been produced for the period of record since 1976 for two reasons: first, prior to 1975 the measurement frequencies were low; second, the type of regulation prior to 1976 is not well documented. The same regulating practice was in place for the period from 1976 to 1986, therefore the data should be homogeneous with respect to this parameter.

For the total period of record the lake has been observed to range through 2.04 meters. The highest water level occurred in 1924 (901.440 meters) and the lowest in 1980 (898.400 meters). For the computation period, from 1976 to 1986, the lake experienced a range of 0.99 meters.

Relative to the total period of record there have been no extraordinarily high water levels during the computation period. The daily frequency distributions of the water levels are slightly skewed toward the minimum; however, the period of record chosen is too short to draw any firm conclusions.

The plot of transformed seasonal mean water levels for the period of record shows a definite trend toward lower water levels. This trend is particularly significant because efforts have been made since 1908 to stabilize the water level.

GULL LAKE AT ASPEN BEACH - 05CC006

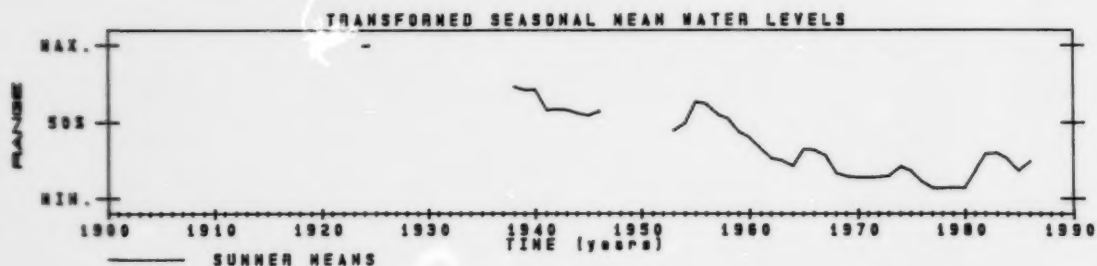
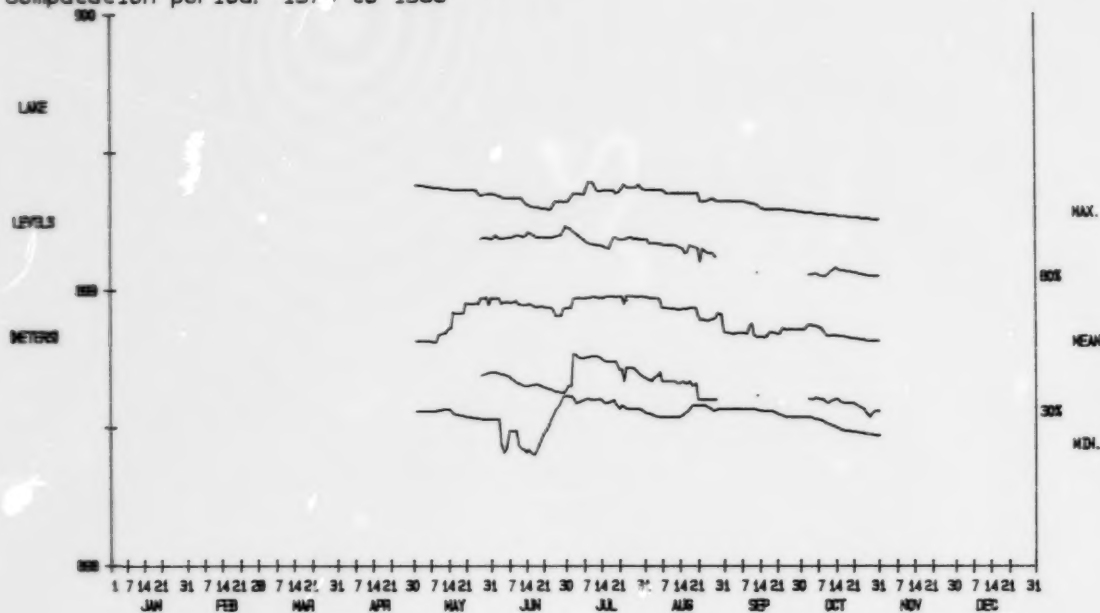
1976 TO 1986

Data Set Statistics

Overall Mean	:	898.902 m	Drainage area	:	289 km ²
Summer Mean	:	898.902 m	Regulation	:	Since 1908
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.286 m	Gauge location - latitude:	:	52° 27' 28" N
Standard deviation - Winter	:	N/A	longitude:	:	113° 58' 03" W
Computation period max. level	:	899.390 m	Percent of recorded data	:	28.4 %
Date of computation period max	:	JUL 9, 1982	Percent of estimated data	:	52.8 %
Computation period min. level	:	898.400 m	Percent of missing data	:	18.9 %
Date of computation period min	:	JUN 17, 1980			
Historical maximum water level	:	901.440 m	Gauge datum	:	Geodetic Survey
Date of historical maximum	:	SEP 2, 1924		:	of Canada Datum
Historical minimum water level	:	898.400 m			
Date of historical minimum	:	JUN 17, 1980			

STATION: GULL LAKE AT ASPEN BEACH
Computation period: 1976 to 1986

NO: 05CC006



2.13 STATION: HASTINGS LAKE NEAR DEVILLE
NO: 05EB011

Hastings Lake is located approximately 40 km east-south-east of Edmonton. Water level data for this lake has been recorded for several periods: from 1919 to 1922; from 1939 to 1941; in 1949; and from 1972 to 1986. Prior to 1972, data were usually collected two to three times a week by a local observer who read a staff gauge. During times of high water, daily observations were made. Gauge readings were originally made at the west end of the lake. When monitoring of the water levels was re-established in 1972 the gauging site was moved to the north shore, a distance of approximately six kilometers. Since that time a local observer has taken daily readings.

The level of this lake is effected by beaver activity. Periodically the beaver dams are removed causing sudden drops in the water level. It is known that dams were removed in 1984 causing a drop in the water level. It is suspected that this may also be the cause of low water in 1972.

Since 1972, Hastings Lake has been observed to fluctuate through a range of 1.073 meters. This range includes the abnormally low water level observed during the 1972 season. The percentile plot shows that over 80% of the recorded water levels from 1972 to 1986 are within a 0.55 meter range.

The departure of the minimum water level line relative to the 20th percentile is greater than the departure of the 20th percentile from the maximum, indicating that the sample of daily values is highly skewed toward the maximum. Water level frequency distributions skewed toward the maximum are rare and are almost always due to man's interference (in this case, the removal of the beaver dams). The constant competition between the beavers building dams and the humans taking them out makes it difficult to determine the natural condition.

The plot of transformed seasonal mean water levels over the period of record shows that data for the initial two years of record, 1972 and 1973, plot very close to the minimum of the range. Subsequent values are closer to the maximum value than the minimum.

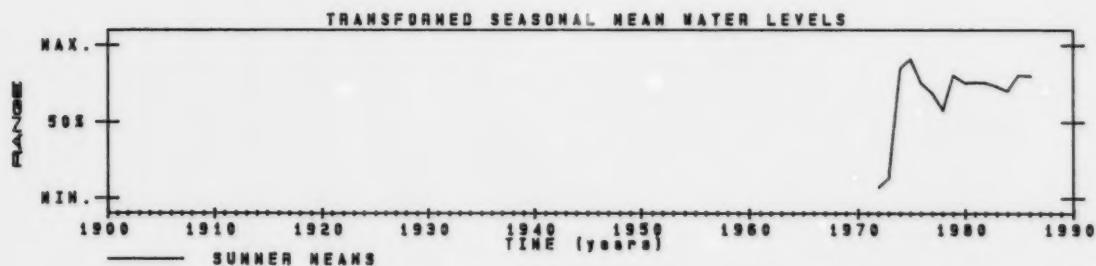
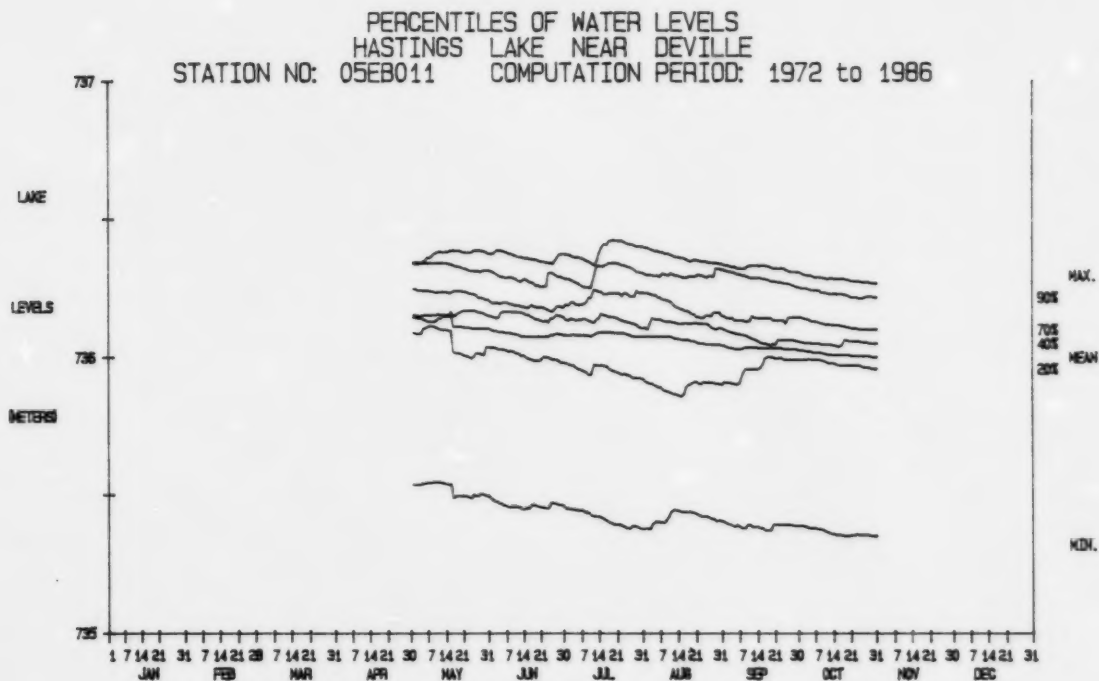
For similar lakes compare Cooking and Miquelon.

HASTINGS LAKE NEAR DEVILLE - 05EB011

1972 TO 1986

Data Set Statistics

Overall Mean	:	736.063 m	Drainage area	:	279 km ²
Summer Mean	:	736.063 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.253 m	Gauge location - latitude:	:	53° 25' 30" N
Standard deviation - Winter	:	N/A	longitude:	:	112° 54' 02" W
Computation period max. level :		736.424 m	Percent of recorded data :		99.4 %
Date of computation period max:		JUL 20, 1974	Percent of estimated data:		0.0 %
Computation period min. level :		735.351 m	Percent of missing data :		0.6 %
Date of computation period min:		OCT 18, 1972			
Historical maximum water level:		736.424 m	Gauge datum	:	Approximate
Date of historical maximum :		JUL 20, 1974			Geodetic Survey
Historical minimum water level:		735.351 m			of Canada Datum
Date of historical minimum :		OCT 18, 1972			



2.14 STATION: ISLE LAKE AT EUREKA BEACH
NO: 05EA008

This shallow lake, located about 80 km west of Edmonton, is approximately 15 km long and 2 km wide. Throughout the 15 year history of record at this site, water level observations were made by a local observer who took daily readings from a staff gauge for the May to October season. During that time the lake experienced a maximum range in water level of 1.055 meters. In a single season the water level generally changes through a range of 0.4 meters and often peaks in July.

The maximum water level line shown on the percentile plot is a composite of the maximum daily water level values for the entire period of record. For the most part it represents 1974 values (both peaks); 1977, 1978, and 1982 values also contribute to its shape. The large departure of the maximum value line from the 80th percentile indicates that the May 1974 water levels were extraordinarily high. The minimum water level line is made up of data from 1973, 1974, and 1985.

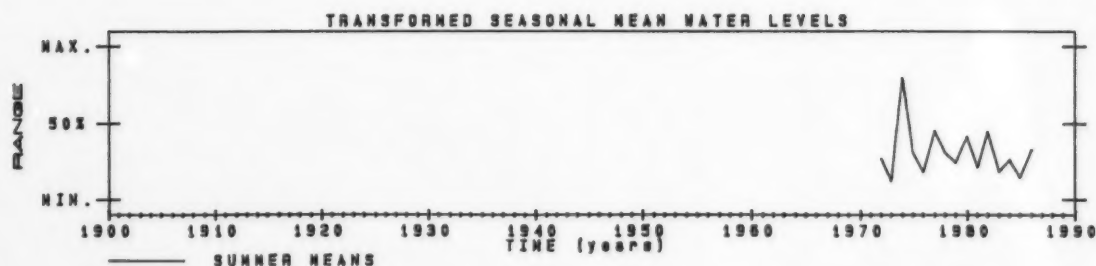
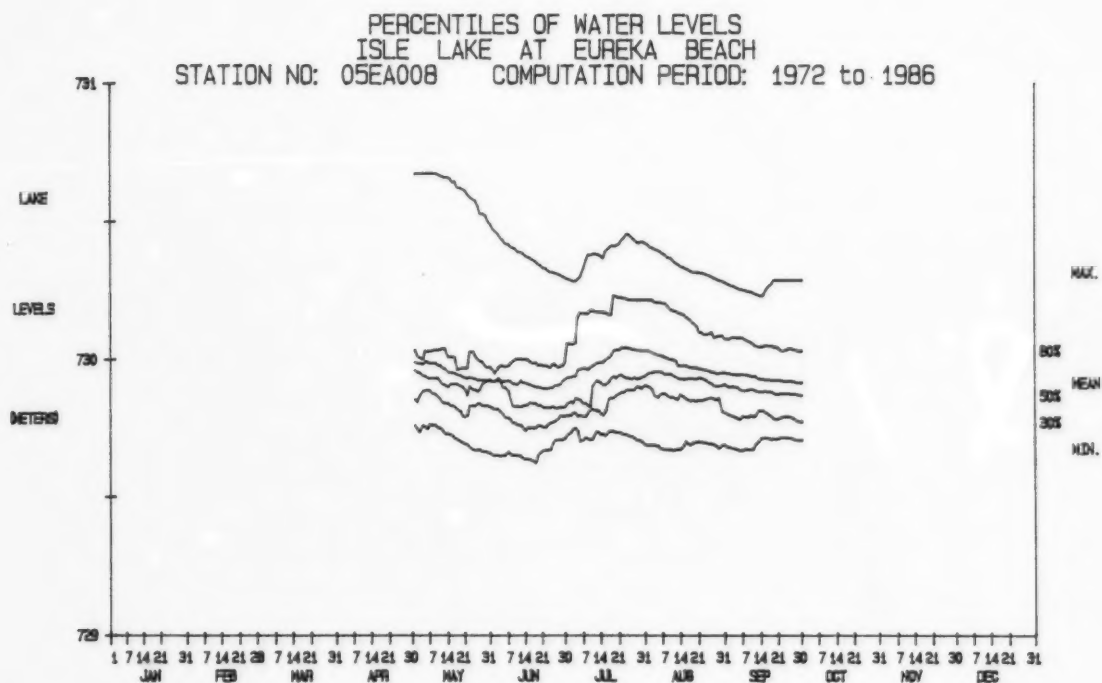
The plot of transformed seasonal mean water levels shows that, except for 1974, the values plot in the bottom half of the total observed range. This is further indication that the water levels during the summer of 1974 were abnormally high. Apart from the single high value plotted for 1974, the plot of transformed summer mean values is evenly distributed over the bottom half of the range, and no trend toward increasing or decreasing water levels is apparent.

ISLE LAKE AT EUREKA BEACH - 05EA008

1972 TO 1986

Data Set Statistics

Overall Mean	:	729.953 m	Drainage area	:	278 km ²
Summer Mean	:	729.953 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.199 m	Gauge location - latitude:	:	53° 37' 22" N
Standard deviation - Winter	:	N/A	longitude:	:	114° 42' 01" W
Computation period max. level :		730.676 m	Percent of recorded data :		77.3 %
Date of computation period max:		MAY 5, 1974	Percent of estimated data:		17.8 %
Computation period min. level :		729.621 m	Percent of missing data :		4.9 %
Date of computation period min:		JUN 18, 1983			
Historical maximum water level:		730.676 m	Gauge datum	:	Approximate
Date of historical maximum :		MAY 5, 1974			Geodetic Survey
Historical minimum water level:		729.621 m			of Canada Datum
Date of historical minimum :		JUN 18, 1983			



2.15 STATION: LAC LA BICHE AT LAC LA BICHE
NO: 07CA004

Lac La Biche is located approximately 174 km north-east of Edmonton. The data for this lake is of particular value since there is a long period of record and the lake is not regulated.

Except for 1932, data is available from 1930 to 1986. Usually, gaps in the annual series of record are not allowed in the computation period; however, the value of including the second highest water level (that which occurred in 1930) was considered against using a data set with one year missing. From written correspondence with local observers during that time it is known that in 1932 no extraordinarily high or low water levels were observed. Since the record for a single year amounts to only 1.8% of the total, it was decided to include the data from 1930 and 1931 in the computation of the percentiles.

Gauge readings were generally made once a week during the open water season from May to October. In 1985 a recording gauge was established to provide continuous record on an annual basis.

The water level for this lake can reach its peak anytime from late July through to September. In order of magnitude, the three highest water levels on record occurred during the following years: 1960, 1930, and 1974.

During the 55 year history of observations at this site the total range in water levels was 2.265 meters. In 1940, the local observer commented that the water level was the lowest he could recall in 20 years. If that was indeed the lowest water level in the 20 years prior to 1940, then for the May to October season 543.056 meters is at least a 65 year low.

The distribution of the percentiles indicates that the sample of daily water levels is skewed toward the minimum. This is supported by the fact that the 60th percentiles and the mean water levels throughout the season very nearly coincide.

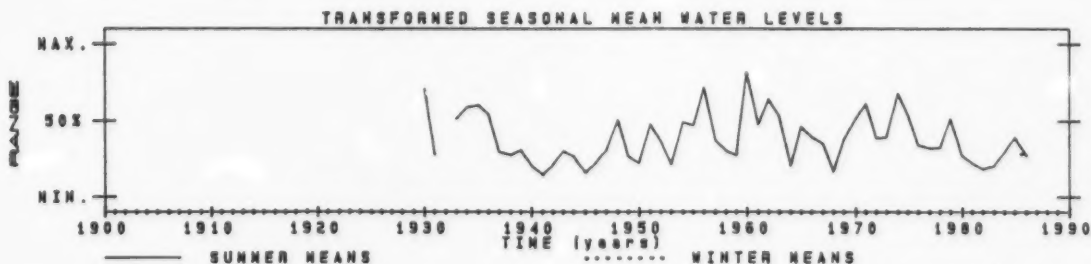
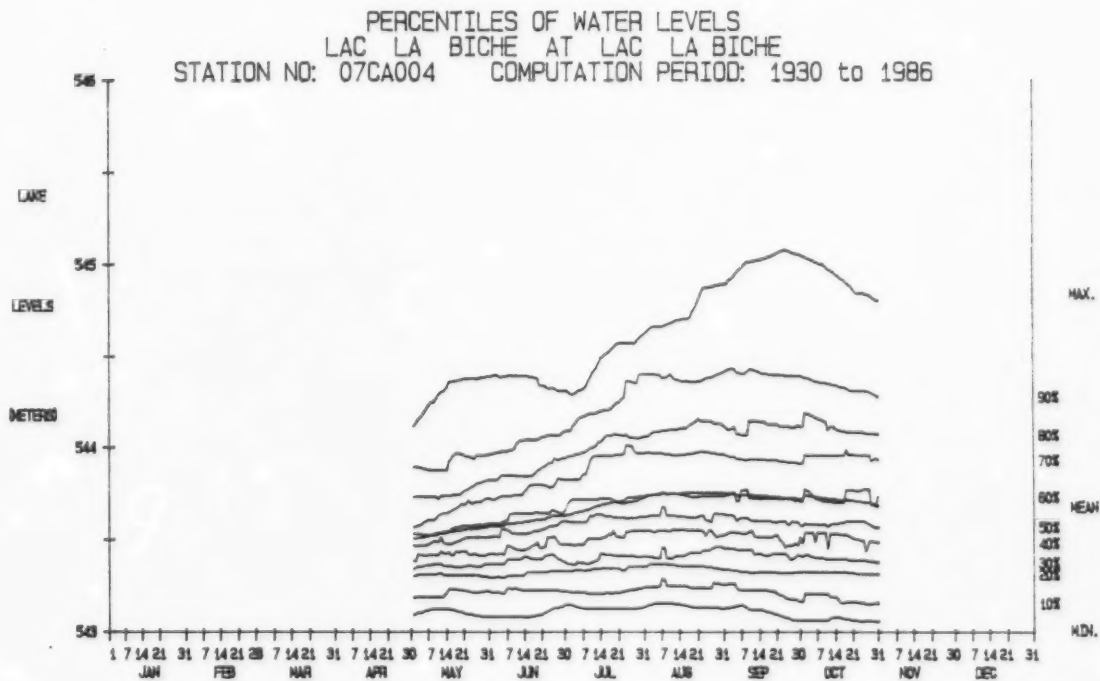
The comparison of transformed seasonal mean water levels for the period of record shows that of the 55 mean summer water levels, only 11 are in the top half of the range. This indicates that the lake has experienced one or more short duration, abnormally high water levels.

LAC LA BICHE AT LAC LA BICHE - 07CA004

1930 TO 1986

Data Set Statistics

Overall Mean	:	543.678 m	Drainage area	:	4330 km ²
Summer Mean	:	543.678 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.392 m	Gauge location - latitude:	:	54° 46' 21" N
Standard deviation - Winter	:	N/A	longitude:	:	111° 59' 14" W
Computation period max. level:	:	545.077 m	Percent of recorded data:	:	27.3 %
Date of computation period max:	:	SEP 24, 1960	Percent of estimated data:	:	63.6 %
Computation period min. level:	:	543.056 m	Percent of missing data:	:	9.1 %
Date of computation period min:	:	OCT 24, 1940			
Historical maximum water level:	:	545.077 m	Gauge datum	:	Approximate
Date of historical maximum:	:	SEP 24, 1960		:	Geodetic Survey
Historical minimum water level:	:	542.812 m		:	of Canada Datum
Date of historical minimum:	:	NOV 10, 1981			



2.16 STATION: LAC LA NONNE AT LAC LA NONNE
NO: 07BB007

Lac La Nonne is located 66 km north-west of Edmonton. During the 15 year history of record at this site water levels have been recorded by local observers reading a staff gauge. Readings are made during the open water season from the beginning of May to the end of October. The frequency of observation has generally been on a daily basis with occasional lapses to one or three times a week.

The maximum water level line on the percentile plot is a composite of 1974 and 1985 data. The 1985 data formed that part of the graph from June 21 to July 7 and again from the first part of September to the end of October. The rest of the maximum water level line, including both the May and July peak water levels, results from 1974 data.

From 1972 to 1986 the lake has experienced a total range in water level of 0.966 meters for the May to October observation season. That maximum range is 2.4 times the range of 80% of the water levels. The percentile plot shows that the maximum departure of the 80th percentile from the minimum value line is only about 0.4 meters.

For the months of May, July, and August, the daily frequency distributions are generally bell-shaped and skewed toward the minimum. Distributions for June appear to be bell-shaped and symmetrical, and the distributions for September and October take on a more uniform or rectangular shape.

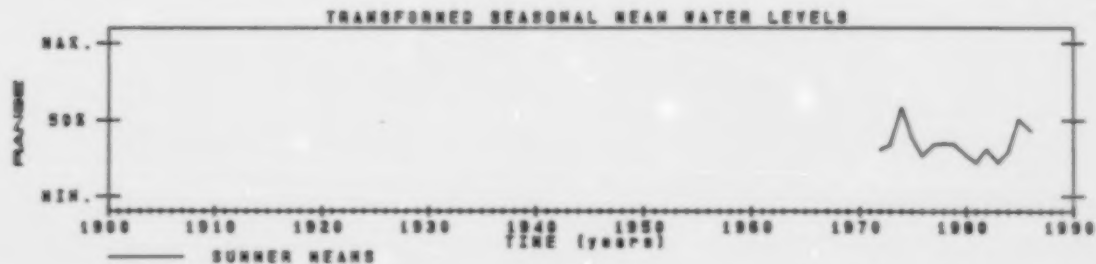
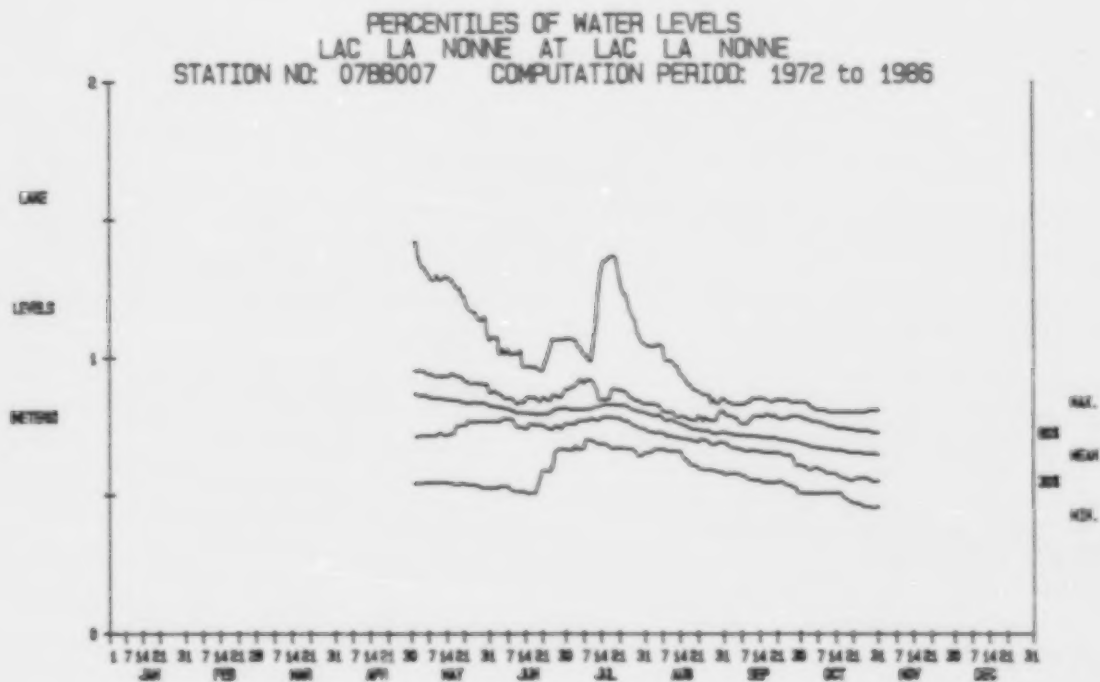
The comparison of transformed seasonal mean water levels for the period of record shows that of the 15 values only 2 are in the top half of the range; as well, these values are all above 25% of the range. This close grouping indicates that, for the short history of record at this site, the water supply to this lake and the outflow are balanced. The plot also provides some information about the duration of the peak. The transformed summer mean for 1974 is very close to 50% of the range indicating that the seasonal mean was significantly less than the peak value. Even though two peaks were observed in that year neither was of long enough duration to bring the transformed summer mean level close to the peak.

For a similar lake in the area compare Lac Ste. Anne.

1972 TO 1986

Data Set Statistics

Overall Mean	:	0.767 m	Drainage area	:	298 km ²
Summer Mean	:	0.767 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.131 m	Gauge location - latitude:	:	53° 54' 41" N
Standard deviation - Winter	:	N/A	longitude:	:	114° 16' 43" W
Computation period max. level:	:	1.420 m	Percent of recorded data:	:	95.4 %
Date of computation period max:	:	MAY 1, 1974	Percent of estimated data:	:	1.3 %
Computation period min. level:	:	0.454 m	Percent of missing data:	:	3.1 %
Date of computation period min:	:	OCT 28, 1981			
Historical maximum water level:	:	1.420 m	Gauge datum	:	Arbitrarily Assumed
Date of historical maximum:	:	MAY 1, 1974			
Historical minimum water level:	:	0.454 m			
Date of historical minimum:	:	OCT 28, 1981			



2.17 STATION: LAC STE. ANNE AT ALBERTA BEACH
NO: 05EA006

Lac Ste. Anne is located 60 km west of Edmonton and 15 km north of Wabamun Lake. Various local observers have recorded the May to October water levels at this site since 1933. Prior to 1974 readings were made once a week. Since that time readings have been made on a daily basis, with the occasional lapse to two or three times a week.

The maximum water level line shown on the percentile plot is a composite of four individual years of record; in order of decreasing water levels these are: 1974, 1954, 1944, and 1965. The April to May peak for 1974 shows up on many of the lakes throughout east-central Alberta. The minimum water level line represents data from 1939 and 1942.

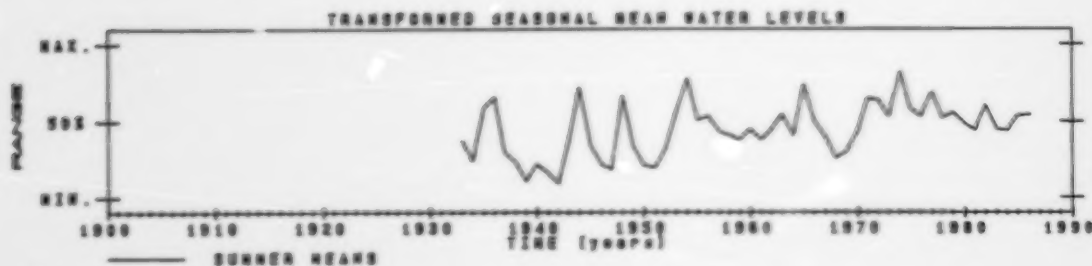
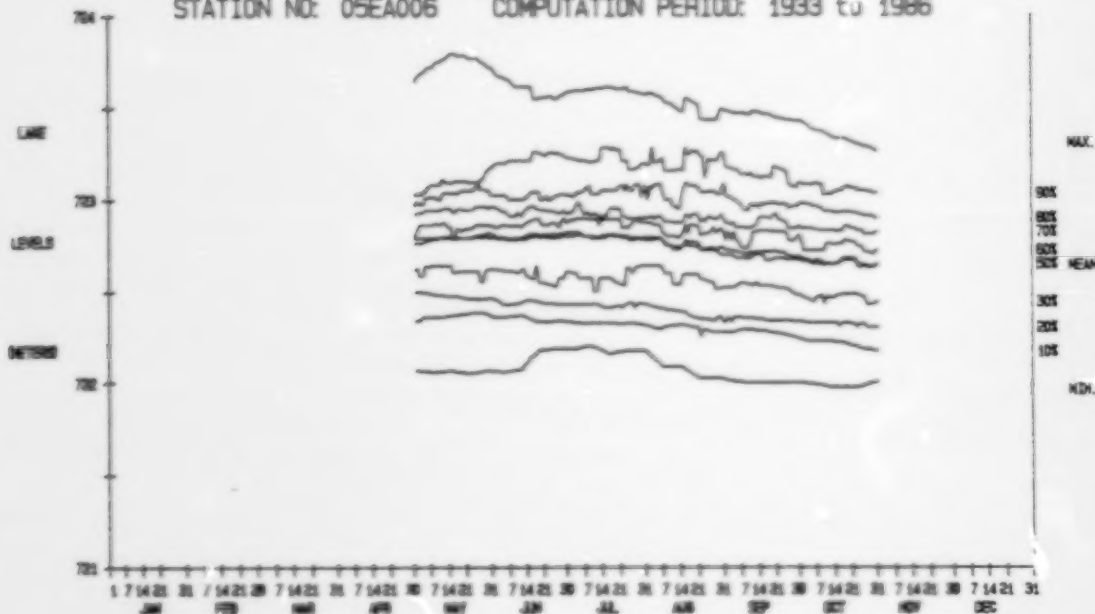
For the 54 years of record shown here, the water level of the lake has fluctuated through a range of 1.810 meters. The maximum and minimum seasonal variation for the period was 0.948 meters and 0.100 meters, respectively. On average, the water level of this lake ranges over 0.318 meters for the May to October season.

The percentile plot of daily water levels represents bell-shaped distributions for the daily water levels for the period of record. As the season progresses, the relative departures of the percentiles becomes more uniform, indicating that the distributions are flattening, yet still retain a bell shape.

The plot of transformed summer mean water levels for the period of record shows an increase in these values over time. As well, this plot shows a decrease in year to year variation since 1971.

1933 TO 1986

PERCENTILES OF WATER LEVELS
LAC STE. ANNE AT ALBERTA BEACH
STATION NO: 05EA006 COMPUTATION PERIOD: 1933 to 1986



2.18 STATION: LAKE ATHABASCA AT FORT CHIPEWYAN
NO: 07MD001

Lake Athabasca is located in the north-east corner of Alberta. Water level data has been collected at this site since 1930 with only the years 1932, 1933, 1958, and 1959 missing from the record. Prior to 1960 manual gauge readings were taken with recording frequencies ranging from once a month to daily. Since 1960 a strip chart recorder has been used to provide continuous data. From 1930 to 1968, observations were made from May to October; since 1969, water levels have been recorded year round.

The Peace River is a periodic tributary to Lake Athabasca. This occurs when the water level in the river is higher than the lake. At these times inflow from the Peace River contributes to lake storage and retards lake outflow. The Bennett Dam was built on the Peace River during the mid-1960's and began effecting the Peace River discharges in December of 1967. Since that time the flood volumes have been reduced and peaks attenuated, thus reducing the water contribution to Lake Athabasca and allowing greater outflows.

In an effort to maintain minimum lake levels a rock filled dam was placed on the Chenal des Quatre Fourches at the outlet of Mamawi Lake in 1971 and then removed in December of 1975. In 1976 weirs were placed on the two other main outlet channels: Revillon Coupé, and Rivière des Rochers. To ensure that the water level record used for the percentile plot are effected by the same degree of regulation, only the values since 1977 have been used.

For the 53 years of available data, the lake has experienced a total range of 5.70 meters. During the period from 1977 to 1986, as shown on the percentile plot, the range in water level was 3.83 meters.

The maximum water level line on the percentile plot represents 1979 data for May and June and 1977 data for the rest of the year. The minimum water level line represents 1982 data until late June and 1981 data to the end of the year. Gaps in the lines for the 30th and 80th percentiles are due to insufficient record.

Comparing the transformed seasonal mean water levels for the period of record shows that all of the summer means except for 1968, 1969, 1970, and 1971, plot in the top half of the range; winter values for these four years are also extremely low. Low water during this period may be due to the effect of the Bennett Dam but this is not certain.

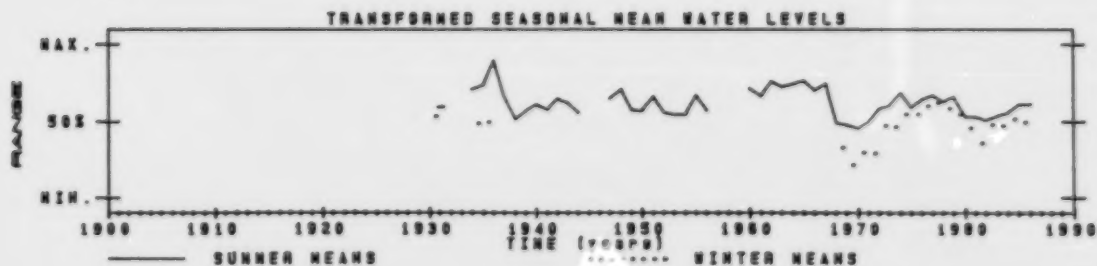
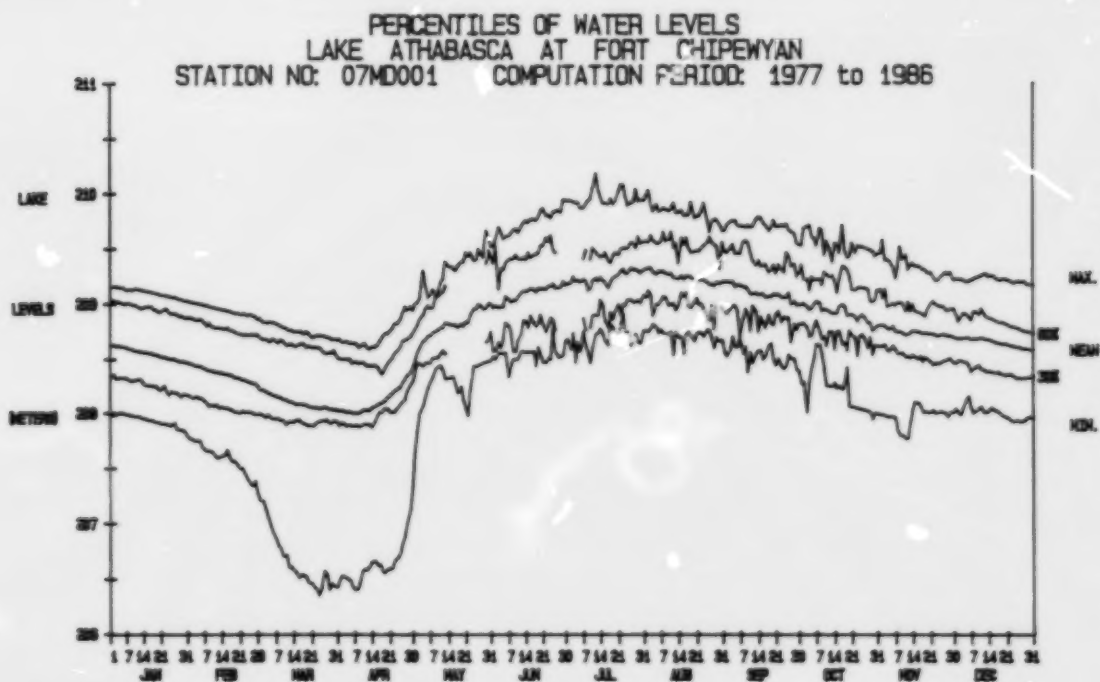
The plot of transformed seasonal mean water levels since 1970 appears to have a smoother trace and lower values. This may be a result of the controls on the Peace River and on the outlet channels from the lake; however, comparing this part of the trace to data prior to 1960 can be misleading due to the differences in observation frequencies and length of the operating season. From the present data set no trend toward lower values can be concluded.

LAKE ATHABASCA AT FORT CHIPEWYAN - 07MD001

1977 TO 1986

Data Set Statistics

Overall Mean	:	208.739 m	Drainage area	:	271 000 km ²
Summer Mean	:	209.066 m	Regulation	:	Since 1967
Winter Mean	:	208.422 m			
Standard deviation - Summer	:	0.418 m	Gauge location - latitude:	:	58° 42' 40" N
Standard deviation - Winter	:	0.518 m	longitude:	:	111° 08' 50" W
Computation period max. level:	:	210.190 m	Percent of recorded data:	:	92.6 %
Date of computation period max:	:	JUL 12, 1979	Percent of estimated data:	:	5.0 %
Computation period min. level:	:	206.360 m	Percent of missing data:	:	2.4 %
Date of computation period min:	:	MAR 24, 1982			
Historical maximum water level:	:	211.330 m	Gauge datum	:	Geodetic Survey of Canada Datum
Date of historical maximum:	:	JUL 14, 1935			
Historical minimum water level:	:	206.630 m			
Date of historical minimum:	:	AUG 22, 1953			
Data contributed by	:	ALBERTA DEPARTMENT OF THE ENVIRONMENT			



2.19 STATION: LAKE CLAIRE NEAR OUTLET TO PRAIRIE RIVER
NO: 07KF002

Lake Claire is located in the north-east corner of Alberta. Water level data have been collected at this site since March 1970; however, prior to 1975 readings were too infrequent to produce a percentile plot. For the computation period from 1975 to 1986, data has been recorded by a continuous strip chart recorder.

The highest water levels on record occurred in 1974, prior to the start of the computation period. For 1974, daily values are available only for the months of July, August and September; miscellaneous readings were taken for the rest of the year. Therefore, in order to better indicate the observed range in water levels the 1974 data has been shown on the plot as a dotted line.

The maximum water level line on the percentile plot represents data from 1976, 1977, 1979, and 1985. The minimum water level line represents 1982 data from January, to mid-July and 1981 data from mid-July to December.

For the period of record shown, the percentile plot indicates that there is a more frequent occurrence of observations closer to the maximum water level. Had there been enough data to include the 1974 data in the percentile plot construction, the modal value of the daily water levels would have shifted toward the minimum. Since the record for a single year has such a definite impact on the frequency distributions of the sample, it can be concluded that, for this period of record, water levels that occurred in 1974 were extraordinarily high.

The plot comparing transformed seasonal mean water levels for the period of record shows increasing water levels from 1970 to 1974 followed by a decrease to 1982. The same pattern can be seen in the plots for other Alberta lakes: e.g., Bear, Cold, Fawcett, Isle, Mamawi, Miquelon, and South Wabasca.

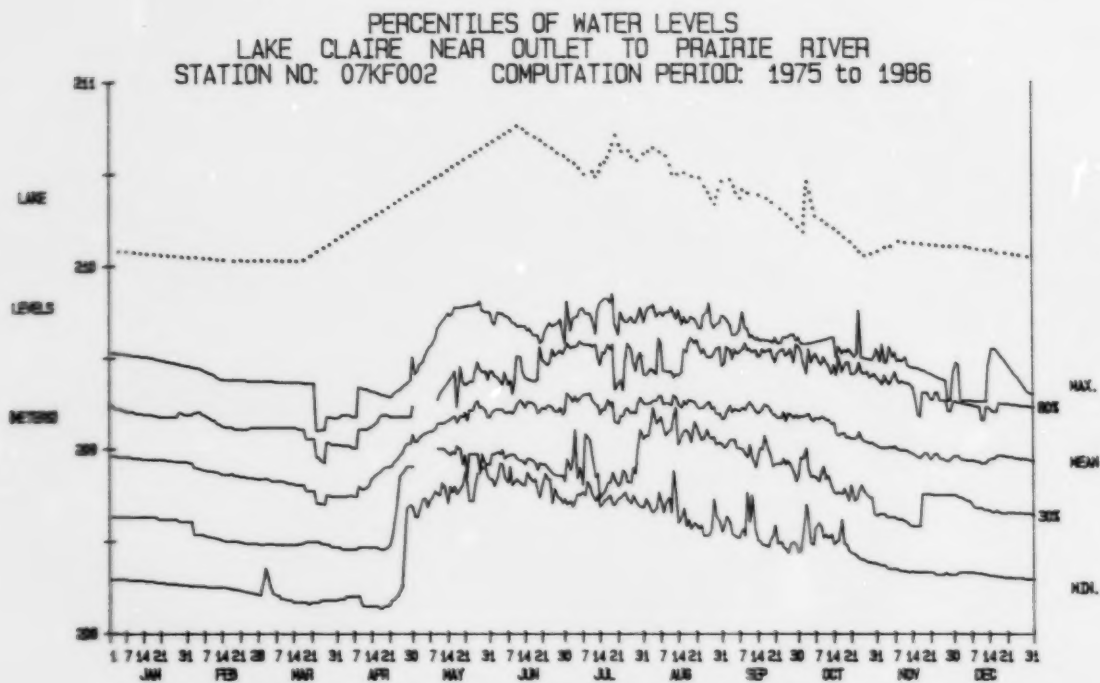
LAKE CLARIE NEAR OUTLET TO PRAIRIE RIVER - 07KF002

1975 TO 1986

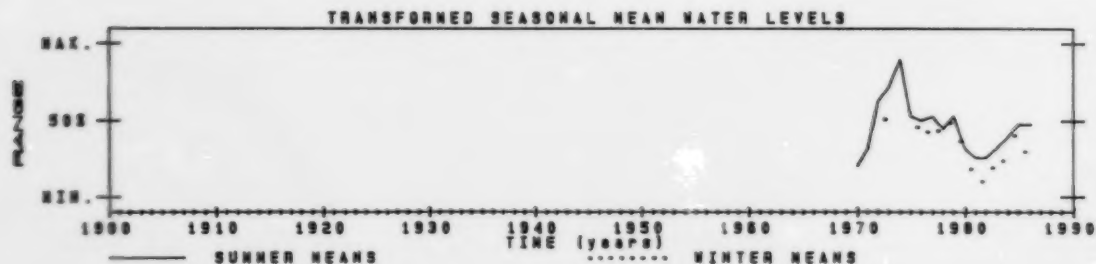
Data Set Statistics

Overall Mean	:	209.043 m	Drainage area	:	N/A
Summer Mean	:	209.198 m	Regulation	:	Since 1967
Winter Mean	:	208.891 m			
Standard deviation - Summer	:	0.326 m	Gauge location - latitude:	:	58° 38' 00" N
Standard deviation - Winter	:	0.348 m	longitude:	:	111° 41' 50" W
Computation period max. level :		209.850 m	Percent of recorded data :		74.7 %
Date of computation period max:		JUL 19, 1979	Percent of estimated data:		13.7 %
Computation period min. level :		208.140 m	Percent of missing data :		11.6 %
Date of computation period min:		APR 17, 1982			
Historical maximum water level:		210.760 m	Gauge datum	:	Approximate
Date of historical maximum :		JUN 11, 1974			Geodetic Survey
Historical minimum water level:		208.030 m			of Canada Datum
Date of historical minimum :		MAR 18, 1970			

Data contributed by : ALBERTA DEPARTMENT OF THE ENVIRONMENT



Note - The dotted maximum line is estimated from miscellaneous measurements of 1973-74.



2.20 STATION: LESSER SLAVE LAKE AT FAUST
NO: 07BJ002

Lesser Slave Lake is located in central Alberta. Apart from the years 1930 and 1950, the water level has been monitored at the site near Faust since 1923. Prior to 1960 readings were generally made once a week. From 1960 to 1977, daily observations were made; since 1978, instantaneous water levels have been recorded on continuous strip-charts.

A weir was installed at the outlet to control the lake level in 1984. The elevation of the weir crest is 575.5 m, relative to the Geodetic Survey of Canada datum. This elevation is very near the minimum recorded water level of 575.493 m (May 01, 1941). As a rule regulated data is not analyzed with unregulated data; however, in this case the control structure is not expected to influence the distribution of the percentiles until the water level is closer to the elevation of the weir crest.

Since 1923 the lake level has been observed to range through 2.864 meters. Fluctuations in the water level for individual seasons range from 0.155 meters (1951) to 1.511 meters (1979). The seasonal variation, in any single year, is more commonly between 0.4 and 0.8 meters.

The maximum water level line is made up of data from three different years: 1965 for the months of June, July, and October; 1977 for the month of May; and 1979 for the months of August and September. In 1935, the measurement frequency was not high enough for the data to be included in the percentile plot; however, the readings for September and October were the highest on record for these months, therefore a dotted line has been added to the plot to give a better indication of the observed range.

The minimum water level line is also made up of data from three different years: 1940 for September and October; 1941 for May and June; and 1944 for July and August.

The frequency distributions of the daily water levels are generally bell-shaped yet quite flat. The modal values tend to be skewed toward the minimum.

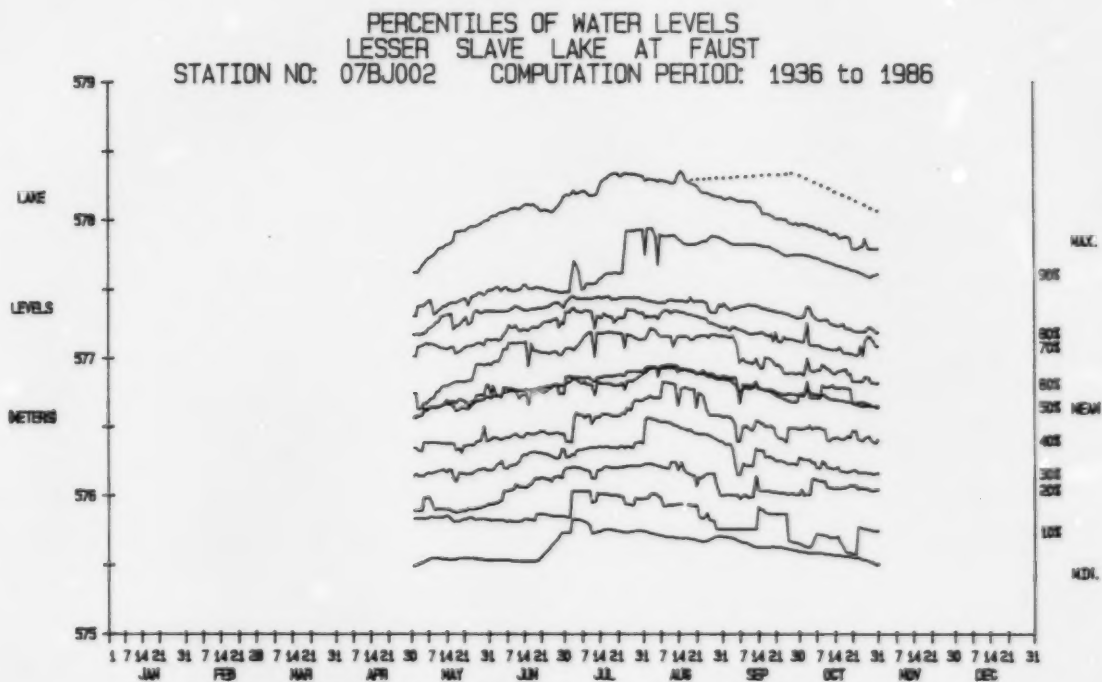
Transformed seasonal mean water levels plot over the entire observed range during the entire period of record and no trend toward higher or lower water levels is apparent.

LESSER SLAVE LAKE AT FAUST - 07BJ002

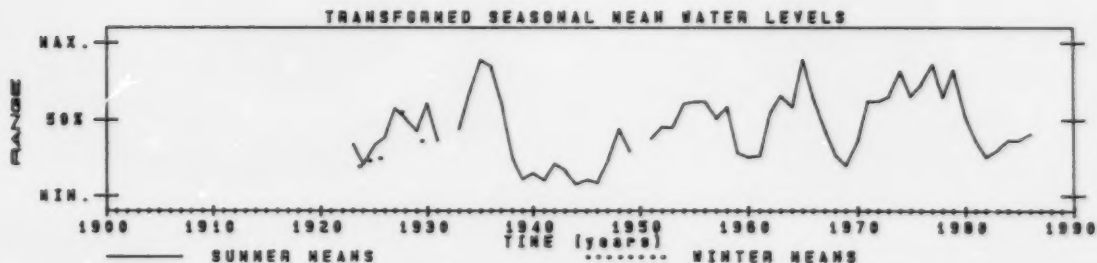
1936 TO 1986

Data Set Statistics

Overall Mean	: 576.772 m	Drainage area	: 13 600 km ²
Summer Mean	: 576.772 m	Regulation	: Since 1984
Winter Mean	: N/A		
Standard deviation - Summer	: 0.676 m	Gauge location - latitude:	55° 19' 15" N
Standard deviation - Winter	: N/A	longitude:	115° 37' 25" W
Computation period max. level :	578.357 m	Percent of recorded data :	54.8 %
Date of computation period max:	AUG 15, 1979	Percent of estimated data:	28.4 %
Computation period min. level :	575.493 m	Percent of missing data :	16.7 %
Date of computation period min:	MAY 1, 1941		
Historical maximum water level:	578.357 m	Gauge datum	: Geodetic Survey of Canada
Date of historical maximum :	AUG 15, 1979		
Historical minimum water level:	575.493 m		
Date of historical minimum :	MAY 1, 1941		



Note - The dotted maximum line is estimated from miscellaneous measurements of 1936.
Also, in 1984, a fixed-crest weir with crest elevation 575.5 m was constructed.



2.21 STATION: MAMAWI LAKE CHANNEL AT OLD DOG CAMP
NO: 07KF003

Mamawi Lake is located in north-eastern Alberta, between Lake Athabasca and Lake Claire. Data is available since 1971 but complete years of record have been available only since 1975. A rockfill dam was constructed at the outlet of the lake in November of 1971 and removed in December of 1975. Only the data collected after the removal of the dam were used to construct the percentile plot.

For the entire period of record, data has been collected with a continuous strip-chart recorder. Since 1971 the lake has experienced a range of 4.79 meters, yet for the computation period the lake has experienced a range of only 3.3 meters. Since removal of the dam in 1976 the annual ranges have been as low as 1.29 m (1978) and as high as 2.56 m (1986).

The maximum water level line on the percentile plot is, for the most part, made up of data from 1979 for mid-April to August and data from 1977 for the rest of the year.

The minimum water level line is made up of data from the following years: 1982 for March to mid-May, 1983 from mid-May to the end of June, and 1981 for the rest of the year.

The frequency distributions of the water levels on a calendar day basis are shown by the percentile plot. For the winter months these distributions are generally U-shaped; i.e., bi-modal, skewed toward both extremes. During the summer months the distributions are more uniform.

The plot comparing transformed seasonal mean water levels for the period of record shows that prior to 1979 the majority of the values plot in the top half of the range; since 1980, most values are in the bottom half. Nevertheless, since 1974 all values plot close to the middle of the range and no trend toward increasing or decreasing water levels is apparent.

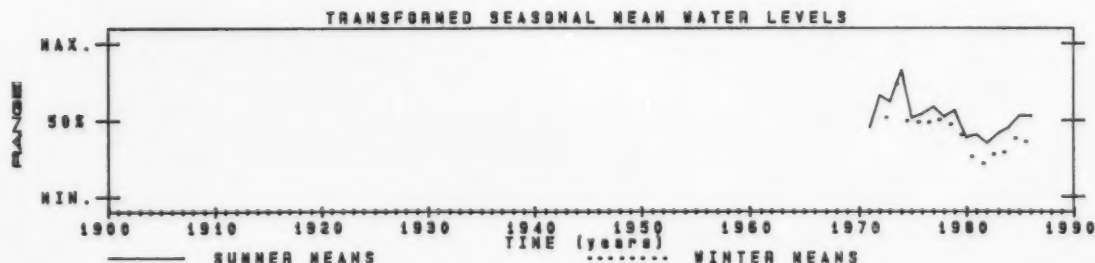
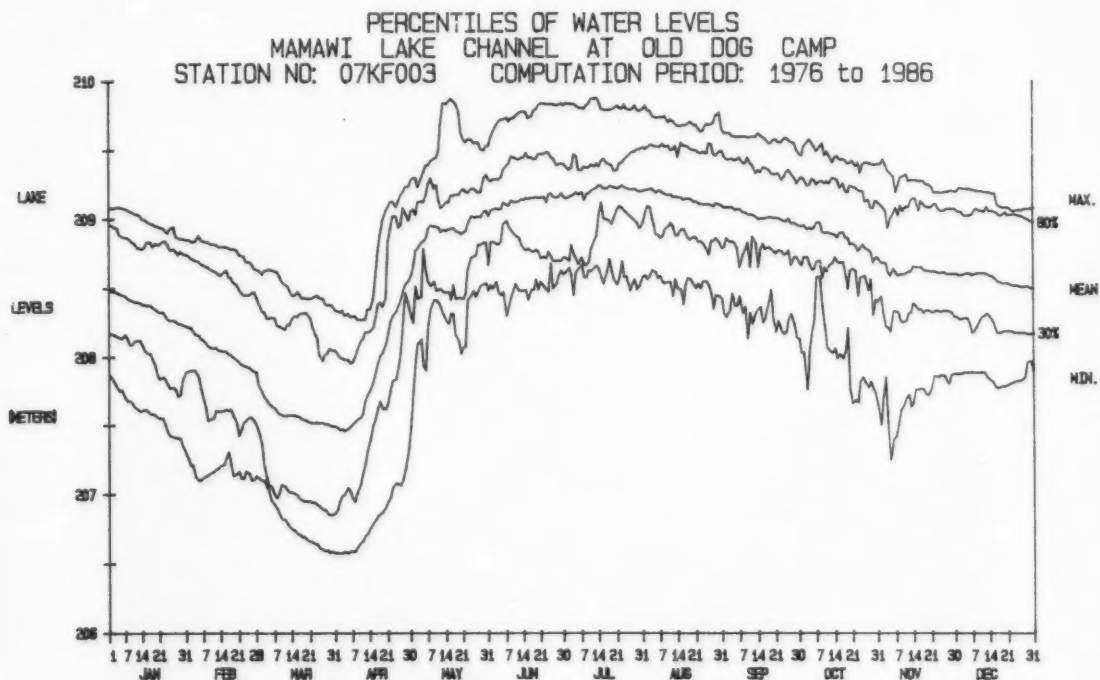
MAMAWI LAKE CHANNEL AT OLD DOG CAMP - 07KF003

1976 TO 1986

Data Set Statistics

Overall Mean	:	208.617 m	Drainage area	:	N/A
Summer Mean	:	209.046 m	Regulation	:	Since 1967
Winter Mean	:	208.191 m			
Standard deviation - Summer	:	0.421 m	Gauge location - latitude:	:	58° 38' 00" N
Standard deviation - Winter	:	0.652 m	longitude:	:	111° 20' 00" W
Computation period max. level:	:	209.880 m	Percent of recorded data:	:	87.5 %
Date of computation period max:	:	JUL 13, 1979	Percent of estimated data:	:	8.6 %
Computation period min. level:	:	206.580 m	Percent of missing data:	:	3.9 %
Date of computation period min:	:	MAR 29, 1982			
Historical maximum water level:	:	211.370 m	Gauge datum	:	Approximate
Date of historical maximum:	:	MAY 3, 1974		:	Geodetic Survey
Historical minimum water level:	:	206.580 m		:	of Canada Datum
Date of historical minimum:	:	MAR 29, 1982			

Data contributed by : ALBERTA DEPARTMENT OF THE ENVIRONMENT



2.22 STATION: MIQUELON LAKE AT PROVINCIAL PARK
NO: 05EB014

Located 50 km south-east of Edmonton, Miquelon Lake is one of a group of lakes that includes Cooking, Ministik, Hastings and Beaverhill. These lakes were formed by the retreating continental ice sheet. Lakes in this area were once joined as a chain of lakes but the steady reduction in water volume has resulted in the present group of lakes now joined by small, intermitent streams. During times of high water most of these lakes will spill into the streams and collect in Beaverhill Lake. At one time the waters from Beaverhill Lake spilled through Beaverhill Creek to the North Saskatchewan River; however, its present level is approximately three meters too low to contribute.

Water level data have been collected by a local observer since 1972. The frequency of observations has changed over the years: from 1972 to 1978, daily observations were made; from 1979 to 1982, readings were made monthly; and from 1983 to 1986, readings were made 2-3 times per week. The observation season has changed from a May to October season for the years from 1972 to 1978, to a March to October season for the years from 1979 to 1986.

For the period of record the lake has experienced a range for May to October water levels of 1.22 meters and the average range in water level during any single season is 0.220 meters.

The maximum water level line on the percentile plot represents 1974 data; the minimum water level line is from data collected in 1978. Gaps in the 30th and 80th percentile lines are due to insufficient data.

The plot of transformed seasonal mean water levels for the period of record shows values prior to 1978 to be in the top half of the range and values after 1979 to be in the bottom half of the range. With only 15 years of record no conclusions can be drawn as to the significance of this finding.

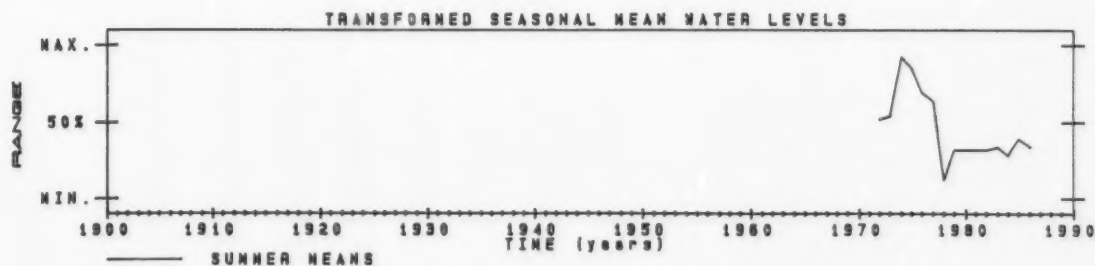
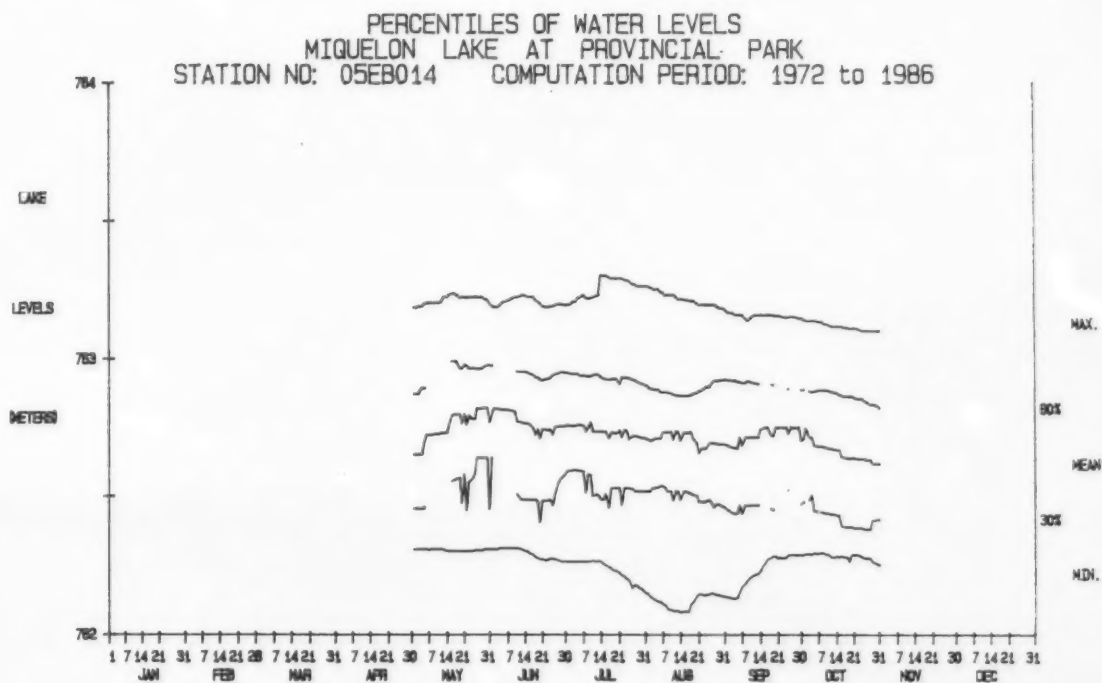
For similar lakes compare Hastings Lake and Cooking Lake.

MIQUELON LAKE AT PROVINCIAL PARK - 05EB014

1972 TO 1986

Data Set Statistics

Overall Mean	:	762.720 m	Drainage area	:	38.3 km ²
Summer Mean	:	762.720 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.297 m	Gauge location - latitude:	:	53° 14' 47" N
Standard deviation - Winter	:	N/A	longitude:	:	112° 54' 24" W
Computation period max. level:	:	763.301 m	Percent of recorded data:	:	49.7 %
Date of computation period max:	:	JUL 14, 1974	Percent of estimated data:	:	14.1 %
Computation period min. level:	:	762.079 m	Percent of missing data:	:	36.2 %
Date of computation period min:	:	AUG 14, 1978			
Historical maximum water level:	:	763.301 m	Gauge datum	:	Approximate
Date of historical maximum:	:	JUL 14, 1974		:	Geodetic Survey
Historical minimum water level:	:	762.079 m		:	of Canada Datum
Date of historical minimum:	:	AUG 14, 1978			



2.23 STATION: PIGEON LAKE AT GRANDVIEW
NO: 05FA013

Located 63 km south and 35 km west of Edmonton, this lake is used intensively for summer recreation. Outflow from the lake is regulated to stabilize the water level and improve the recreational potential. The Alberta government plans to augment the existing control structures in an effort to raise the water level.

Water level data have been collected daily for the May to October season since 1972. During that time the water level of this lake has ranged through 1.04 meters.

The maximum water level line on the percentile plot represents data from 1981, and the minimum water level line represents data from 1972. The relative positions of the 30th and 80th percentiles indicate a uniform distribution of water levels throughout the range.

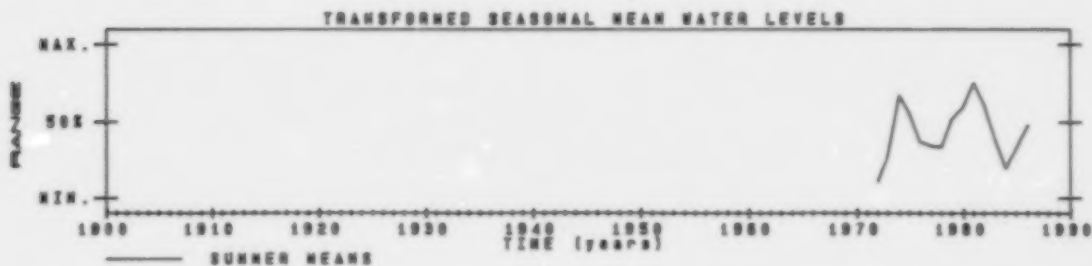
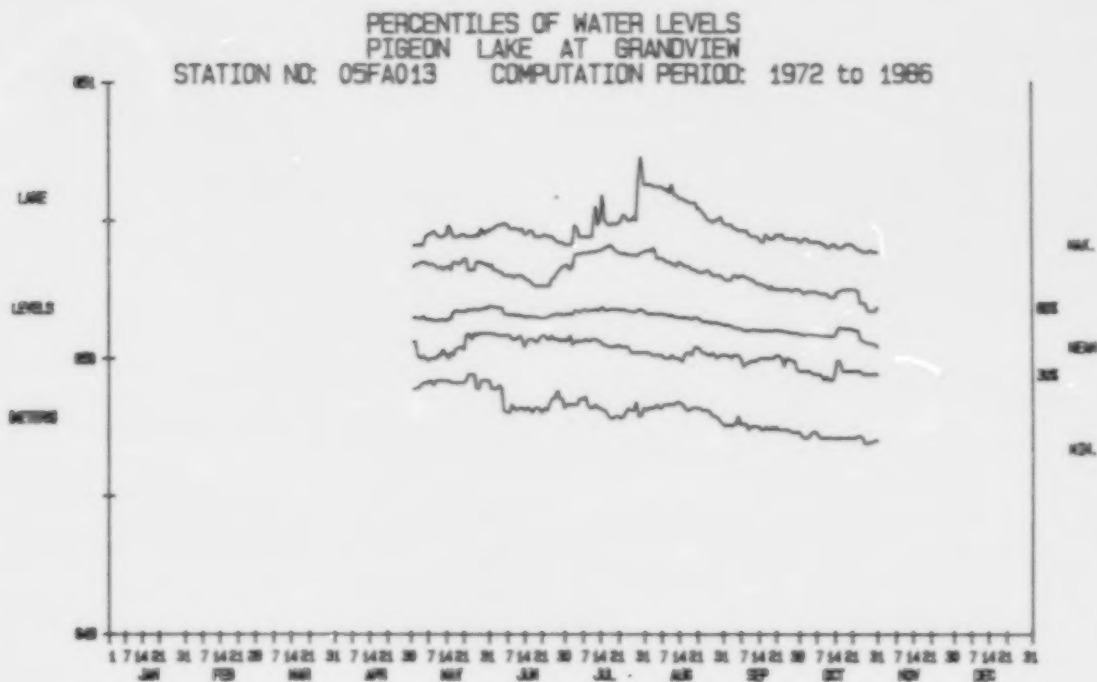
The plot of transformed seasonal mean water levels for the period of record shows that mean summer water levels plot throughout the range and no trend toward higher or lower values is apparent.

PIGEON LAKE AT GRANDVIEW - 05FA013

1972 TO 1986

Data Set Statistics

Overall Mean	:	850.132 m	Drainage area	:	284 km ²
Summer Mean	:	850.132 m	Regulation	:	Prior To Computation Period
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.193 m	Gauge location - latitude:	:	52° 59' 15" N
Standard deviation - Winter	:	N/A	Gauge location - longitude:	:	114° 03' 10" W
Computation period max. level:	:	850.730 m	Percent of recorded data:	:	85.0 %
Date of computation period max:	:	JUL 30, 1981	Percent of estimated data:	:	10.8 %
Computation period min. level:	:	849.690 m	Percent of missing data:	:	4.2 %
Date of computation period min:	:	OCT 26, 1972			
Historical maximum water level:	:	850.730 m	Gauge datum	:	Approximate Geodetic Survey of Canada Datum
Date of historical maximum:	:	JUL 30, 1981			
Historical minimum water level:	:	849.690 m			
Date of historical minimum:	:	OCT 26, 1972			



2.24 STATION: SOUTH WABASCA LAKE NEAR DESMARAIS
NO: 07JA002

South Wabasa Lake is located in central Alberta, approximately 280 km north of Edmonton. This lake is used for both water supply and effluent disposal by the town of Desmarais.

The water level has been monitored at this site since 1972. From 1972 to 1981 the record consists of daily readings taken from a staff gauge by a local observer. From 1982 to 1986, data has been collected continuously with a strip chart recorder. Water level data is available only for the open water season from May to October.

From 1972 to 1986 the water level of this lake was observed to fluctuate through a range of 1.936 meters.

The maximum water level line on the percentile plot shows three distinct peaks: from left to right these peaks represent water levels from the 1974, 1973, and 1983 seasons. The percentile plot also shows that the annual peak water levels usually occur near the end of July or in early August. The minimum water level line on the percentile plot consists of data from the 1980 season for May to mid-August and the remainder of the line represents the 1981 season.

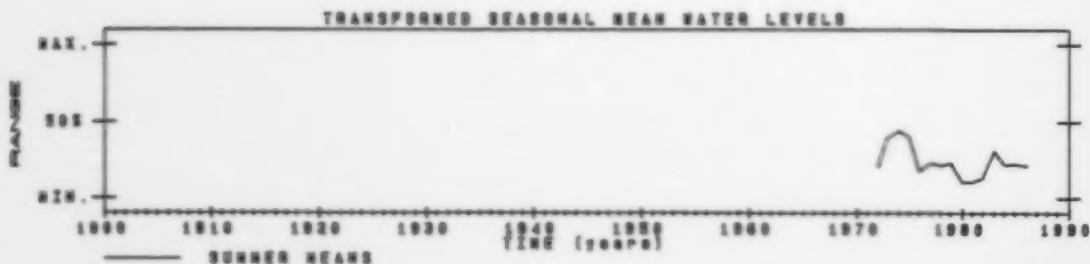
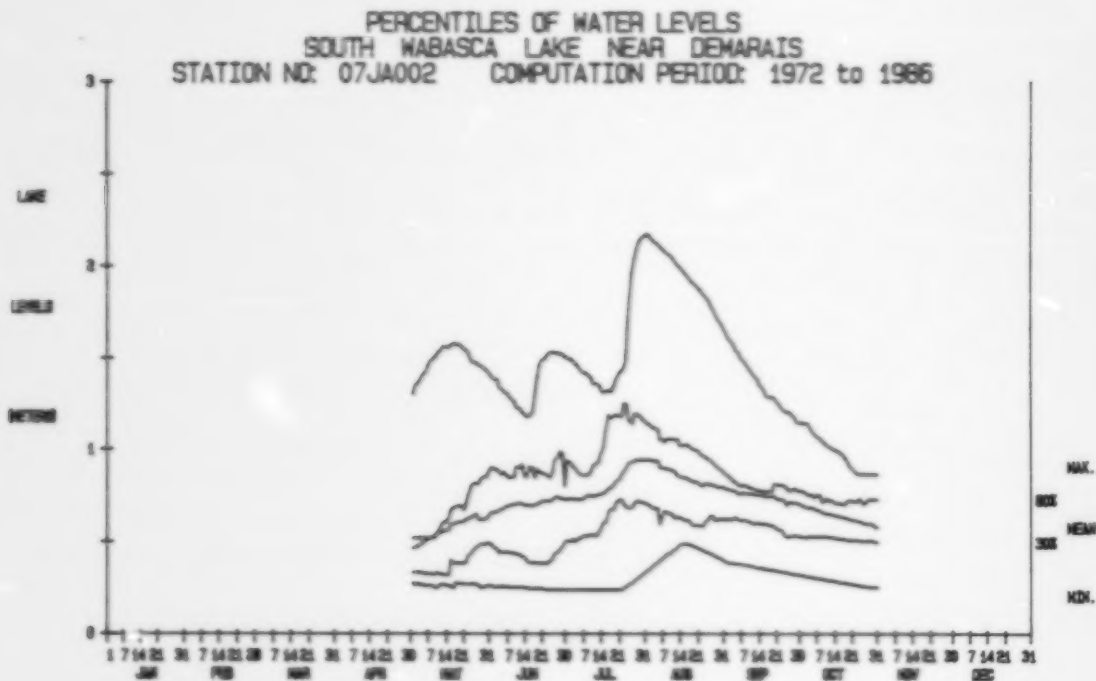
The frequency distributions of daily water levels are generally skewed toward the minimum; this is due to the effect of peak water levels in 1973, 1974, and 1983.

The plot of transformed seasonal mean water levels for the period of record shows that all of the values plot in the bottom half of the range. This indicates that, relative to the available data, abnormally high water levels have occurred in this period. No trend toward increasing or decreasing water levels is apparent.

1972 TO 1986

Data Set Statistics

Overall Mean	:	0.720 m	Drainage area	:	1600 km ²
Summer Mean	:	0.720 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.330 m	Gauge location - latitude:	:	55° 56' 23" N
Standard deviation - Winter	:	N/A	longitude:	:	113° 48' 18" W
Computation period max. level:	:	2.172 m	Percent of recorded data:	:	72.7 %
Date of computation period max:	:	AUG 1, 1983	Percent of estimated data:	:	14.3 %
Computation period min. level:	:	0.238 m	Percent of missing data:	:	12.9 %
Date of computation period min:	:	JUL 22, 1980			
Historical maximum water level:	:	2.172 m	Gauge datum	:	Arbitrarily Assumed Datum
Date of historical maximum:	:	AUG 1, 1983			
Historical minimum water level:	:	0.238 m			
Date of historical minimum:	:	JUL 22, 1980			



2.25 STATION: SYLVAN LAKE AT SYLVAN LAKE
NO: 05CC003

Sylvan Lake is located approximately 15 km west of Red Deer. The water level has been recorded at this site for various times since 1918. From 1918 to 1930, monthly observations were recorded. In 1939, two observations were recorded and in 1940 only one. From 1955 to 1972, monthly observations were made and since 1973 the frequency of observations has been increased to 2-3 times per week. In all cases water levels have been read from a staff gauge either by Water Survey of Canada personnel or by local observers. For the most part, gauge readings were taken during the open water season, from May to October.

The frequency of daily water level values did not become high enough to produce a percentile plot until 1970; however, all of the extremes occurred prior to this time. Therefore, to provide a more accurate representation of the observed range, the extremes have been shown as dotted lines. The dotted maximum water level line is a composite of data from 1927, 1928, 1955, 1956, and 1957. The solid maximum water level line represents data from 1974, 1983, and 1986. The dotted minimum water level line is a composite of data from 1939, 1963, and 1964. The solid minimum value line represents data from 1977, 1979, 1980 and 1981.

The total observed range since 1918 was 1.241 meters. During the computation period chosen for the percentile plot (1970 to 1986) the range in water level was 0.658 meters. From 1956 to 1986, the average range for a single season was 0.224 meters.

The percentile plot indicates that the frequency distributions of daily water levels are generally uniform throughout the season for the computation period. This suggests an equal probability of occurrence for water levels throughout the 0.658 meter range. Furthermore, no extraordinary water levels have been observed from 1970 to 1986.

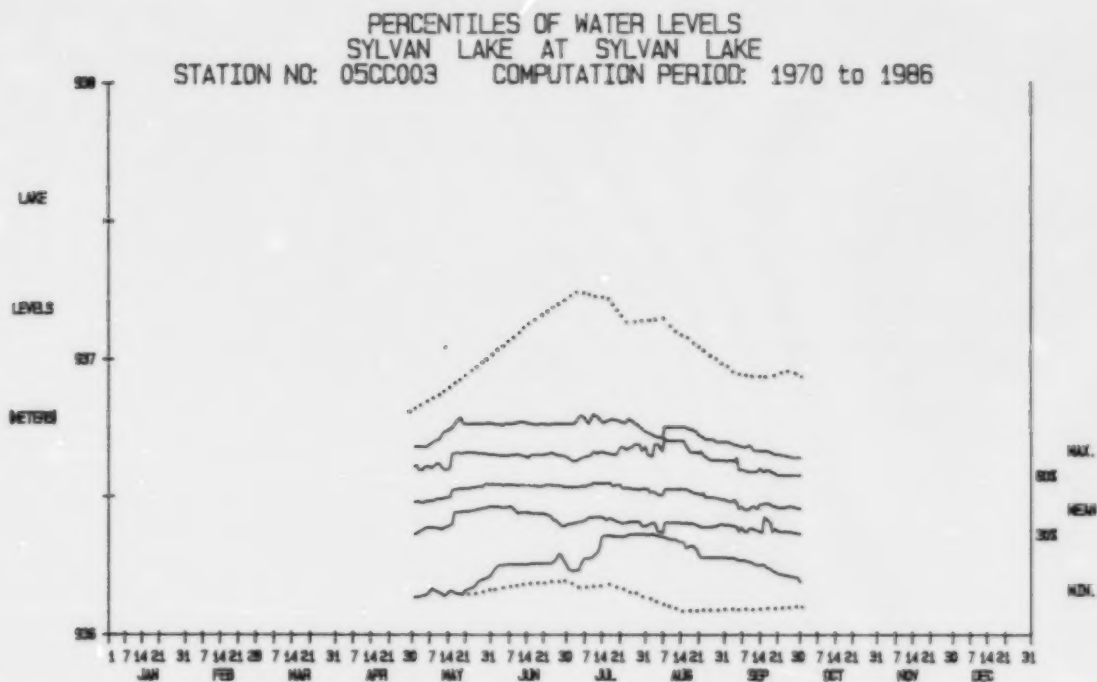
The plot of transformed seasonal mean water levels throughout the total period of record shows that these values are scattered over the entire range; this indicates that no short duration extremes were observed for the entire period of record. However, it does indicate some long term variation. Mean water levels prior to 1960 appear to have been higher.

SYLVAN LAKE AT SYLVAN LAKE - 05CC003

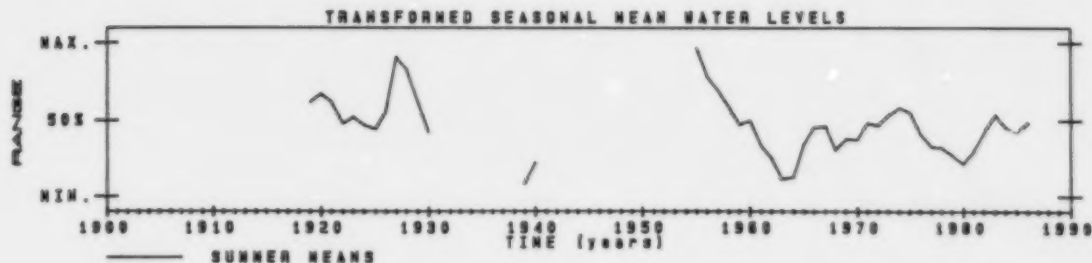
1970 TO 1986

Data Set Statistics

Overall Mean	:	936.516 m	Drainage area	:	151 km ²
Summer Mean	:	936.516 m	Regulation	:	None - NATURAL FLOW
Winter Mean	:	N/A			
Standard deviation - Summer	:	0.146 m	Gauge location - latitude:	:	52° 18' 44" N
Standard deviation - Winter	:	N/A	longitude:	:	114° 06' 08" W
Computation period max. level :		936.797 m	Percent of recorded data :		37.6 %
Date of computation period max:		JUL 11, 1974	Percent of estimated data:		42.2 %
Computation period min. level :		936.139 m	Percent of missing data :		20.2 %
Date of computation period min:		MAY 1, 1980			
Historical maximum water level:		937.248 m	Gauge datum	:	Geodetic Survey of Canada Datum
Date of historical maximum :		JUL 6, 1955			
Historical minimum water level:		936.007 m			
Date of historical minimum :		SEP 8, 1939			



Note - The dotted maximum and minimum lines are estimated from miscellaneous measurements of 1918 through to 1969, see text for details.



2.26 STATION: WABAMUN LAKE AT WABAMUN
NO: 05DE002

Wabamun Lake is located approximately 65 km west of Edmonton. This lake is subjected to high recreational usage; as well, water from this lake is used for cooling at a thermal electric power generating plant. Minimum water levels are maintained by a weir to facilitate both uses.

With the exception of 1932, 1956, 1957, and 1958, water level data has been recorded since 1915. Manual gauge readings have generally been made once a week; occasionally more frequently. The majority of the record is for the May to October season; however, for the period from 1927 to 1931 and from 1960 to 1986, data was collected year round.

The percentile plot has been generated to show the period of record from 1960 to 1986. The historical maximum water level occurred outside this period in 1927; however, its value was only 5 cm greater than the maximum since 1960 and therefore no additions to the range are shown.

The maximum water level line on the percentile plot represents data from 1982; the minimum water level line represents 1961 data from July to December and 1962 data from January to June. For the period of record plotted, the lake experienced a range in water level of 1.31 meters. The largest variation in range for a single year since 1960 was 0.72 meters in 1962. Generally, annual lake fluctuation is approximately 0.3 meters.

The frequency distributions of the water levels on a calendar day basis are shown by the percentiles. For the winter months these distributions are generally U-shaped; i.e., bi-modal, skewed toward both extremes. During the summer months the distributions are more bell-shaped and slightly skewed toward the minimum.

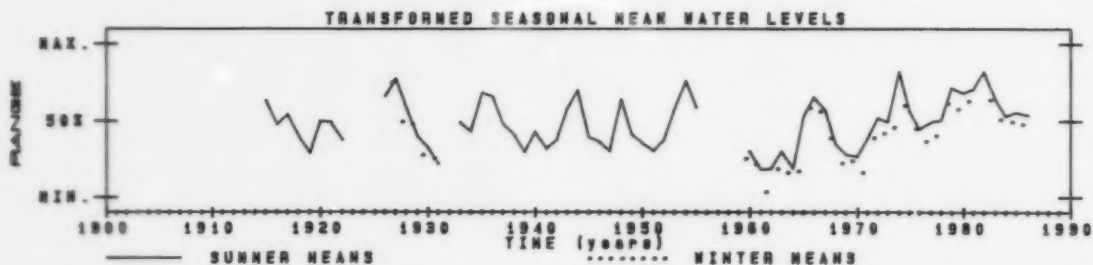
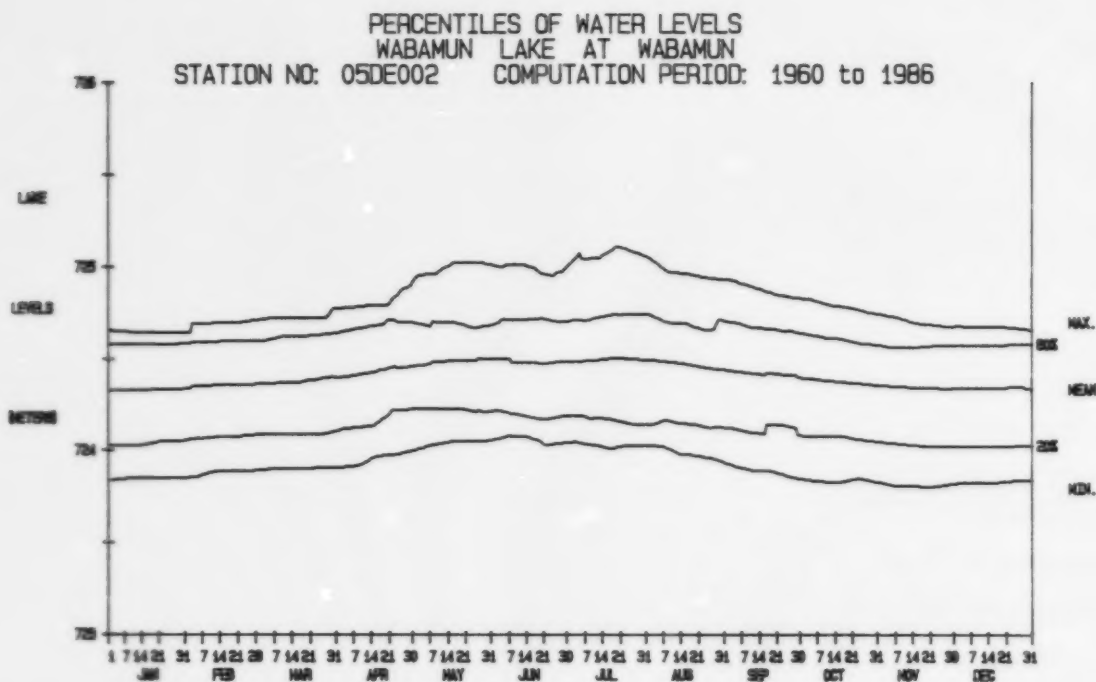
The plot of transformed mean seasonal water levels shows that the water levels fluctuate over the entire range throughout the period of record and that there is no trend toward higher or lower water levels.

WABAMUN LAKE AT WABAMUN - 05DE002

1960 TO 1986

Data Set Statistics

Overall Mean	:	724.405 m	Drainage area	:	355 km ²
Summer Mean	:	724.457 m	Regulation	:	Prior To Computation Period
Winter Mean	:	724.360 m			
Standard deviation - Summer	:	0.262 m	Gauge location - latitude:	:	53° 33' 24" N
Standard deviation - Winter	:	0.239 m	longitude:	:	114° 29' 28" W
Computation period max. level:	:	725.110 m	Percent of recorded data	:	16.6 %
Date of computation period max:	:	JUL 20, 1982	Percent of estimated data	:	82.3 %
Computation period min. level:	:	723.800 m	Percent of missing data	:	1.2 %
Date of computation period min:	:	NOV 20, 1961			
Historical maximum water level:	:	725.160 m	Gauge datum	:	Approximate
Date of historical maximum:	:	MAY 9, 1927		:	Geodetic Survey
Historical minimum water level:	:	723.800 m		:	of Canada Datum
Date of historical minimum:	:	NOV 20, 1961			



2.27 STATION: WATERTON LAKE AT WATERTON PARK
NO: 05AD025

Waterton Lake is located in the extreme south-west corner of Alberta. Water level observations at Waterton Lake began in 1950. From that time to 1958 readings were usually made 2-3 times a week during the months from May to September. From 1959 to 1962, daily readings were made from March to December. Since 1963, readings have been made from January to December with the frequency of observation ranging from 2-3 times a month in the winter to daily in the summer.

The computation period for the percentile plot (1959 to 1986) was chosen so that winter and summer values would be for the same period. During this time the water level of the lake was observed to fluctuate over a range of 4.005 meters. Since 1950 a range of 4.179 meters has been observed.

The lowest water levels on record occurred in 1952 and since the computation period did not begin until 1959, the data from 1952 has been shown as a dotted line to give a better indication of the observed range.

The two sharp spikes in the maximum water level line on the percentile plot represent, from left to right, high water that occurred in 1964 and in 1975. The 1964 event caused the water level of the lake to increase by approximately 3 meters in less than a week.

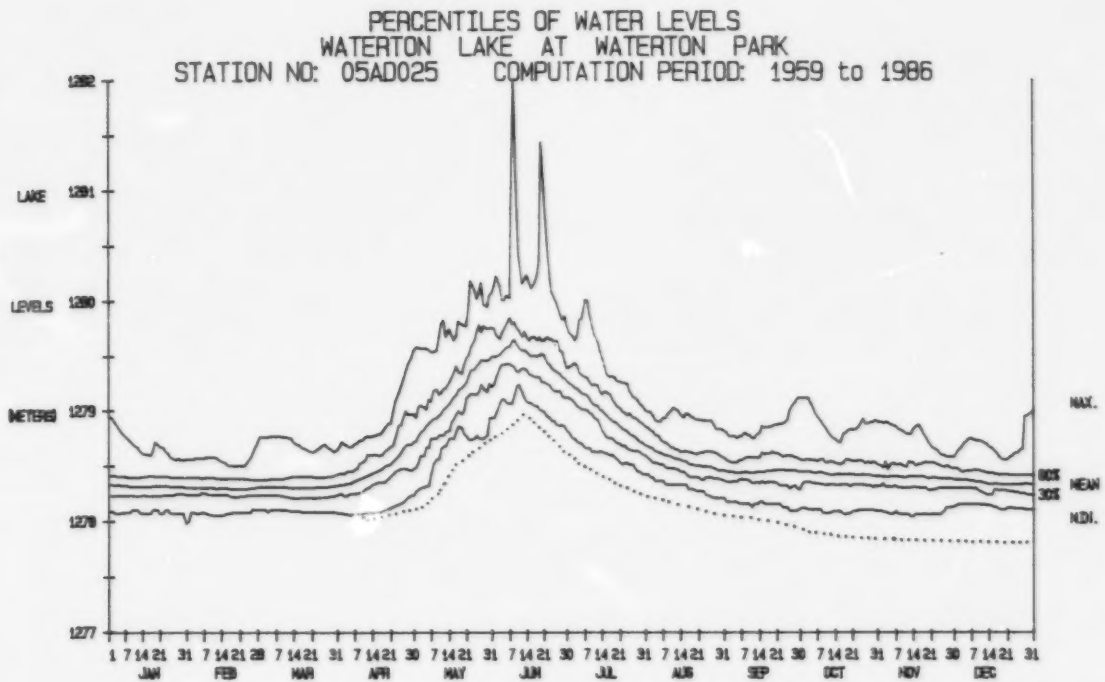
The plot of the transformed seasonal mean water levels for the total period of record shows a slight trend to increasing water levels. As part of the analysis, the June extreme high water levels from 1964 and 1975 were removed from the data set. This reduced the range to 2.43 meters instead of the 4.179 meters shown here and made the trend toward increasing water levels more apparent.

WATERTON LAKE AT WATERTON PARK - 05AD025

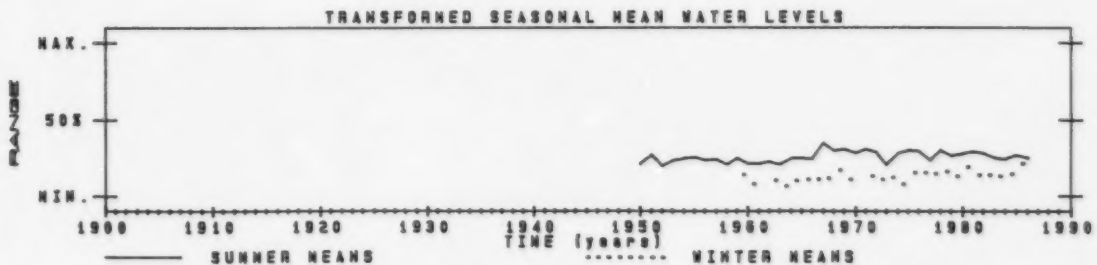
1959 TO 1986

Data Set Statistics

Overall Mean	: 1278.564 m	Drainage area	: 401 km ²
Summer Mean	: 1278.847 m	Regulation	: None - NATURAL FLOW
Winter Mean	: 1278.374 m		
Standard deviation - Summer	: 0.474 m	Gauge location - latitude:	49° 03' 21" N
Standard deviation - Winter	: 0.175 m	longitude:	113° 54' 32" W
Computation period max. level:	1281.989 m	Percent of recorded data:	57.3 %
Date of computation period max:	JUN 9, 1964	Percent of estimated data:	36.8 %
Computation period min. level:	1277.984 m	Percent of missing data:	5.8 %
Date of computation period min:	JAN 31, 1963		
Historical maximum water level:	1281.989 m	Gauge datum	: Geodetic Survey of Canada Datum
Date of historical maximum:	JUN 9, 1964		
Historical minimum water level:	1277.810 m		
Date of historical minimum:	DEC 24, 1952		



Note - The dotted minimum line is estimated from miscellaneous measurements of 1950-58



BIBLIOGRAPHY

1. Agriculture Canada, "The Determination of Gross and Effective Drainage Areas in the Prairie Provinces" Hydrology Report #104, PFRA Regina, 1983.
2. Alberta Environment, "Alberta Lakes and Reservoirs Reference Index, 1986" Technical Services Division, Edmonton 1986.
3. Environment Canada, "Historical Water Levels Summary - Alberta, 1983" Inland Waters Directorate, Ottawa, 1985.
4. Environment Canada, "IPAR Users' Manual (Interactive Procedure for Automated Retrievals)", Inland Waters Directorate, Ottawa, 1986.
5. Environment Canada, "Lake Athabasca Water Levels, 1930-1970" Water Survey of Canada, Calgary, 1970.
6. Environment Canada, "Lesser Slave Lake Water Levels, 1914-1977", Water Survey of Canada, Calgary, 1978.
7. Environment Canada, "Surface Water Data Reference Index, Canada", Inland Waters Directorate, Ottawa, 1986.
8. Government of Alberta and the University of Alberta, "Atlas of Alberta", University of Alberta Press, Edmonton, 1969.
9. Provincial Museum of Alberta Publication No.5, "A Nature Guide to Alberta". Edited by David A.E. Spalding, Hurtig, Edmonton, 1980.
10. Reuna, M. "Annual Hydrographs and Duration Curves of Water Level", National Board of Waters, Finland, Helsinki, 1979.